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THE PROFESSIONAL GEOGRAPHER

VOLUME XIII SEPTEMBER 1961 NUMBER 5

LOG TOWING RATES IN COASTAL BRITISH COLUMBIA

Walter G. Hardwick

The University of British Columbia

TRANSPORTATION of logs through the Inside Passage between Vancouver Island and the mainland is a basic operation in the important forest industry of British Columbia. Although unit cost of this transportation is relatively low, as is the case with many raw materials, the volume of timber utilized in production of processed wood products makes raw material transportation charges a significant element in the total cost of such products. As transportation charges are one of the few costs which differ from one forest operation to another, these charges are important in determining locational advantages and disadvantages of various sites. A knowledge of the pattern of transportation rates, and the means of determining these rates, is therefore essential in production cost and site location analyses.

Many geographers apparently consider the subject of freight rates to be highly complex, and either ignore the topic in studies of locational problems or merely estimate transportation charges by equating cost with distance. However, not every problem in which transportation plays a role need deal with transportation rate structures as complex as those of the American railroads. Very often, contract and company-owned carriers are engaged in providing transportation service, and actual rate structures can be secured by contacting industry representatives. This is particularly true in primary industries.

The marine towing industry on Canada's west coast is a good example. Towboat companies move most of the logs, pulpwood chips, and hog fuel that are used as raw materials in the coastal forest industry. The British Columbia Towboat Owner's Association publishes a rate guide *(1)* as a service to its customers, the logging operators. Thus, for a student of the coastal forest industry of British Columbia, highly reliable rate data are available.

However, let us assume that this rate guide is unavailable, and that actual transportation costs between only a few places can be secured. Under such circumstances, how successfully would a simple rate model serve as a substitute for specific data in a site location analysis of mills and logging camps? In order to answer this question, a model of theoretical rates for the British Columbia log towing industry is first developed (Fig. 1), and then is compared with the actual pattern of rates as set forth in the industry's rate guide (Fig. 2).

Process of log transportation. Logs are the largest single commodity transported along the coast of British Columbia. Lindsay *(2)*, writing in 1958, indicates that approximately 6,500,000 tons are moved annually. The logs usually are dumped into the water at camps, where they are assembled into booms and towed to large storing and sorting grounds farther south along the coast. Several places, such as Gambier Island near Vancouver (Fig. 2), serve as warehousing centers, where logs, cut more rapidly in the woods than they can be utilized in mills, are stored so that regular supplies are available for processing during periods of forest closure. The Gambier Island storing grounds, the immediate destination of many log tows, is the point at which are based both the theoretical and actual log towing rates employed in this study (Figs. 1 and 2).

Along the Inside Passage, logs move in so-called flat booms, which are large areas of logs, floating side by side in parallel rows, enclosed by a log framework. The sides are held in place by extra long logs called boom sticks; swifters, i.e., logs which are pulled across the assembled

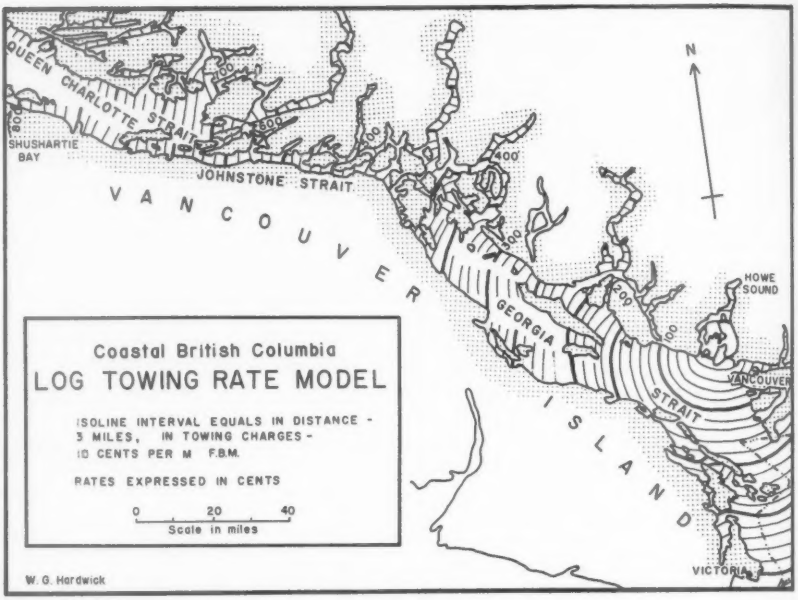

FIG. 1. Log towing rate model.

mass, give it a certain degree of rigidity. Swifters are located at 66-foot intervals (one chain), creating an appearance of square enclosures termed sections. The volume of logs in each section is measured by government scalers, and is expressed in units of thousands of board feet. This measure, which will hereafter be expressed as F.B.M., is the unit in which towing rates are expressed.

For efficient transportation from logging camp to log storing ground, a number of booms are assembled into tows ranging from 20 to 60 sections in size. Tows of over 60 sections usually are unmanageable. A tow of 60 sections, about 198 feet wide by 1,360 feet long, has an area of 246,000 square feet or about six acres. Assuming, as towing companies do, a minimum scale of 30,000 F.B.M. per section, a tow of 60 sections has a minimum volume of 1,800,000 F.B.M. Further assuming a value for the logs of $50.00 per 1,000 F.B.M., such a tow has a value of $90,000.

A log boom is a useful transportation vehicle and can be constructed quickly and at low cost. However, as each log is floating independently of any other log, and is simply enclosed in a framework, a boom is always susceptible to the hazard of water sufficiently rough to throw logs out of the boom. Moreover, the fact that a log boom covers such a large area restricts towing speed to about two miles per hour.

Log towing rates in theory. Many factors that influence the determination of freight rates on American railroads, a topic dealt with at some length in 1958 by Alexander and associates (3), do not apply to towing rates in coastal British Columbia. There is only one commodity. Variations in value of the commodity do not affect the rate making process – just volume. Government regulation of rate making is unknown, except as pertaining to the federal anti-combines (anti-trust) legislation; therefore, competition is a fact. There is no possibility for less-than-carload-lot rates. Hence, many of the factors that can create complex rate structures do not exist in the situation under study. A good case, therefore, can be made for equating transportation cost with distance; and development of a valid log towing rate model for coastal British Columbia appears feasible. Such a model follows.

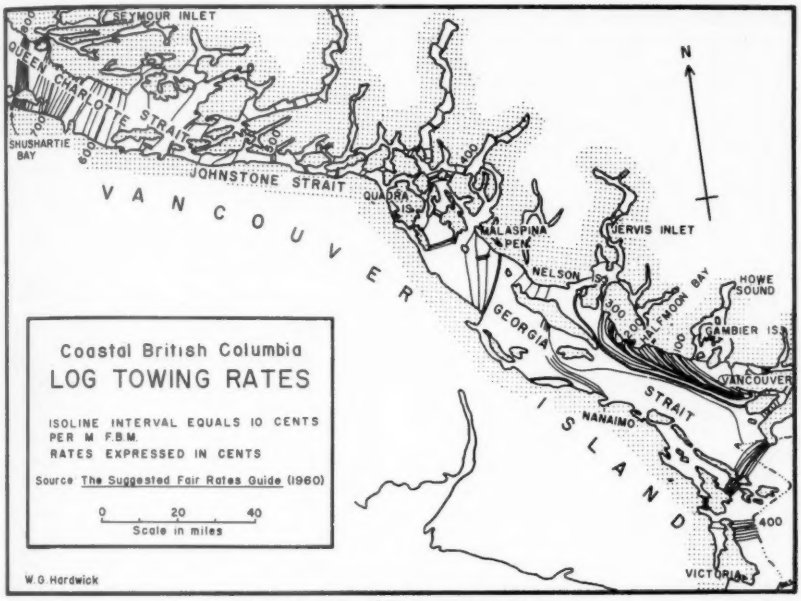

FIG. 2. Actual log towing rates.

Towing charges between Shushartie Bay (Fig. 1), the most northerly settlement on the sheltered side of Vancouver Island, and Gambier Island can be ascertained from the Towboat Owner's Association. From this charge of $8.10 per thousand F.B.M., a threshold charge of 40 cents per thousand F.B.M. is subtracted. The remainder, $7.70, is divided by the 240 miles involved. In round figures, a charge of 10 cents for every three miles is indicated. On a base map of the relevant area, small arcs are drawn along the towing channels at intervals of three miles. The completed map, Figure 1, then, illustrates a model pattern of log towing rates where cost is equated with distance. From this model, conclusions can be reached as to the relative locational advantages of various sites, and prognostications can be made on the potential ability of timber from various places to compete in specific markets.

Figure 1 portrays the model. How well does it illustrate reality?

Actual log towing rates. Figure 2 represents actual log towing charges in British Columbia coastal waters, as determined from data published in the rate guide. Comparison of Figures 1 and 2 indicates that the model does not illustrate actual rates over wide areas. True, Shushartie Bay has the same rate on both maps; but few other places have this distinction, a fact which can be of critical significance in site location and production cost analyses.

How can deviations of reality from the model be explained? A transportation economist might suggest that the role of constant costs in determining rates is being overlooked, and that its omission nullifies the model. When constant costs are high, higher charges are made per unit of distance on the first units of transportation service than in subsequent units. This is referred to as the tapering rate principle. When this principle is operative, isolines become increasingly far apart toward peripheral areas. Observation of the actual pattern of rates represented in Figure 2 does not confirm the thesis that it is omission of the tapering rate principle which nullifies the model.

Other factors might be entertained to explain deviations of reality from the model. Can it be one-way tows, labor costs, or competition? Upon inspection, none of

these seems to be the key. Nor does volume of goods influence the pattern since the general practice is to award discounts for volume rather than to alter the rate schedule. Instead, deviations of the real pattern from the model pattern appear to be related (1) to the necessarily slow speed of log tows, (2) to areal variations in susceptibility of the commodity to loss through rough water and storm conditions, and (3) to differences in size of towboats needed to perform the towing service in various channels.

Because of the extremely slow towing speed, it can take a tug 12 hours to travel 24 miles; and, on the British Columbia coast, expected intervals between heavy seas may be little more than 12 hours. Portions of the coastal channels where rough water is a relatively common occurrence, therefore, become natural obstacles; and towboats frequently are forced to await calm weather at such places before proceeding. Wherever these areas occur, a rapid rise in towing rates can be expected.

The narrower channels, in which tidal currents sometimes reach speeds of from four to ten knots and are accompanied by eddies and whirlpools, also are dangerous to navigate. Tugs often have to lie over from four to six hours and await slack water before proceeding. Increases in rates at such obstacles also can be expected. However, as tides move southward along the various channels between Vancouver Island and the mainland, a skilful skipper can navigate in such fashion as to take advantage of several slack tides, one after another, and thereby avoid layovers. Thus, of the two obstacles, heavy seas associated with open water are a much greater threat to the tug and its tow than are tidal currents, and therefore have more significant influence on rates. A few examples, taken from various sections along the coast, will illustrate the above contentions.

Just northwest of Vancouver, between Howe Sound and Jervis Inlet (Fig. 2), an exposed section of mainland coast along Georgia Strait acts as an obstacle to regular movement of flat booms approaching from the northwest. Because of the orientation and exposure of this 24-mile-long strip of coast, it is equally buffeted by southeast gales which precede a Pacific storm and by northwest winds which follow it. Moreover, distances between points where shelter may be secured are greater than normal along this stretch of coast. Under such conditions, towboat owners are forced to use larger and more powerful tugs than might be expected, and delays are common, thus resulting in higher than normal towing charges per unit of distance. The close spacing of isolines in this region, as shown in Figure 2, in a site so near the basing point, might suggest that, in fact, a tapering-rate principle is very much in evidence. However, closer inspection of the map will indicate that, within the protected waters of Howe Sound and Vancouver Harbour (Fig. 2), rates per unit of distance are much lower and resemble those found in other protected areas along the coast. Certainly, since Howe Sound and Vancouver Harbour are so very close to the basing point, evidence of a tapering-rate principle should be noted there if anywhere. Instead, the opposite is true, since the threshold charge necessary for tugs powerful enough to tow logs in Georgia Strait is considerably greater than that for the small tugs used in Howe Sound and Vancouver Harbour. It is not surprising, then, that rates per unit of distance rise rapidly once the open waters of Georgia Strait are entered.

From a short distance northwest of Halfmoon Bay on the east coast of Georgia Strait (Fig. 2), northwestward for some 50 miles to beyond Malaspina Peninsula (Fig. 2), the occurrence of sheltered harbours and passages at frequent intervals allows the flow of logs to progress with few delays, and rates per unit of distance are quite low. In case of rough seas in the open Strait, tugs can ply alternate routes or seek temporary shelter. For example, they can follow the northwest side of Jervis Inlet, go eastward around the islands at the mouth of the Inlet, and then sail south through narrow Agamemnon Channel, thus avoiding a very dangerous cape on the south end of Nelson Island (Fig. 2). Although such alternate routes may increase distances, they may actually reduce the time element.

East of Quadra Island, and farther north in Johnstone Strait (Fig. 2), towing rates are generally low except at local sites. Log tows along both these stretches of the Inside Passage generally move southeastward through the maze of channels on the mainland side, rather than along the more di-

rect and wider channel bordering Vancouver Island, even though distances are longer, because the probability of calm water is greater.

Farther northwest, in Queen Charlotte Strait (Fig. 2), rates rise rapidly northwestward because of the progessively more exposed nature of the Strait. Near the open ocean, at Shushartie Bay, charges per unit of distance are extremely high (Fig. 2).

Northward beyond Vancouver Island, along the northern British Columbia coast, and along the west coast of Vancouver Island, flat log booms are towed only in locally protected areas; they are not normally towed on the open Pacific Ocean. *(4)* Instead, self-dumping log barges have been designed to serve in such exposed waters.

Summary. The theoretical model of log towing rates along the southern British Columbia coast (Fig. 1), developed by equating cost with distance, fails, except in a general way, to account for the actual pattern of transportation rates (Fig. 2). Frequent storms and daily tidal oscillations necessitate delays along certain stretches of the route, and in those places increase the time necessary to carry out the log transportation service.

The pattern of actual log towing rates is impossible to predict without understanding (1) the technology of the log towing industry, and (2) navigational hazards that exist along segments of the British Columbia coast lying between Vancouver Island and the mainland. Thus, although the theoretical model of log towing rates might initially appear to hold promise as a useful research tool, unique local conditions along coastal British Columbia result in establishment of a rate pattern with numerous deviations from the model. It is evident that the value of any study of the log towing industry which is based upon theoretical rates should be questioned.

* * *

(1) British Columbia Towboat Owners' Association, *Suggested Fair Rates Guide*, Vancouver, B.C., revised to July 1, 1960.

(2) Lindsay, J.A., "Coastwise Water Transportation," *11th Transactions, British Columbia Natural Resources Conference*, Victoria, B.C., 1958, pp. 251-258. Lindsay's figure of 3,470,000,000 F.B.M. has been converted into tons.

(3) Alexander, J.S., Brown, E.S., and Dahlberg, R.E., "Freight Rates: Selected Aspects of Uniform and Nodal Regions," *Economic Geography*, Vol. 34, No. 3, January, 1958, pp. 1-18.

(4) Barges towed outside of the Inside Passage are subject to as much as a 50 per cent "weather and tidal allowance" which is added to the normal mileage rate.

SUPPLEMENTARY GEOGRAPHICAL READING MATERIALS

Katheryne Thomas Whittemore

State University College of Education at Buffalo

This is one of a series of guest articles written on invitation by senior members of the geographic profession.

TO RECEIVE an invitation to write one of a series of articles by senior geographers is to be faced by the temptation to give unsolicited advice to junior geographers, to indulge in reminiscences, or to present a current enthusiasm. Fortunately for this senior geographer, whose primary career has been in teaching, it is possible to yield to all three temptations by writing about one aspect of the teaching of geography, namely supplementary reading materials for college students in introductory geography courses.

Two instructional problems encountered in teaching college classes in geography are (1) the location of materials suitable for intensive and extensive reading and (2) the effective use of these materials. The teacher of small advanced classes faces the task of guiding his students in the discov-

ery and use of sound and scholarly work. The teacher of large introductory college classes in geography encounters different and almost insurmountable problems when he wishes to acquaint students with pertinent geographic writings. This article deals primarily with special instructional problems that are related to large undergraduate classes.

Textbook inadequacies. An introductory college course in geography, whether organized in large lecture sections or in several smaller classes, may enroll several hundred students. Among these students are some who come with genuine interest in geography. The majority, however, are enrolled merely to fulfill an academic requirement, and may never register for another course in the field. For this latter group, enrichment reading, in addition to the textbook, is especially important.

The usual college textbook, of necessity, covers a large amount of factual material on many subjects. Little space is available for descriptive and explanatory passages that develop concepts and build images. The writer of the textbook distills from long years of study and personal experience the material that he considers essential for the college student. For example, the author who has visited coffee, cacao, banana, and rubber plantations, and who has collected statistics and examined numerous research studies concerning such enterprises, condenses all such experiences into a few paragraphs about tropical plantation agriculture.

When the college instructor reads the textbook paragraphs, he is reminded of plantations that he has visited, pictures that he has seen, descriptions that he has read, and facts that he has gathered from many sources. He finds the textbook paragraphs well organized and accurate, and the facts well chosen for the particular needs of the students.

The students, however, bring little background to the reading of the textbook. They study the explanations and learn the content of the printed page, but a little prodding reveals that they have only vague concepts and inaccurate images of tropical plantations.

To make the textbook more meaningful to his students, the instructor expands the basic material by adding explanations and enriching details in his class discussions. He is sometimes struck by the similarity of his own task to that of a cook who opens a can of condensed soup. By a long and involved process to which many people have contributed, the vegetables are grown, the meat stocks prepared, and all ingredients are condensed and packed in the container in which the soup ultimately arrives in the kitchen. The artist-teacher, like the artist-cook, not only opens the can and mixes the contents with the necessary liquid, but also adds a dash of herbs, or sherry, or whatever will whet the appetite. The limitations of the class period, and even of the instructor's own experiences, make it highly desirable to refer the students to supplementary readings for that dash of herbs or sherry.

Supplementary reading assignments. Reading assignments outside the textbook not only provide the student with materials that clarify and expand many of the concepts presented, but also serve other useful purposes. They give him the chance to study a topic in greater depth, for even the beginning student deserves to experience the special pleasure that comes from pursuing a subject that has caught his interest.

Students who major in related fields have a particular need for learning the kinds of reference materials that are available and the methods of locating geographic information. Students of economics, anthropology, foreign languages, history, and many other subjects need more geographic education than it is possible to provide in schedules crowded with requirements in their chosen areas of specialization.

Many subjects should be represented in reading assignments for the beginning student. Cultural and physical geography, the geography of past times, accounts of sequent occupance, up-to-date studies of areas and industries in which rapid changes occur, the analysis and interpretation of general topics, examples of specific industries and places – all these aspects of geography should be included.

Of special importance for supplementary reading are regional studies, i.e., the descriptive and analytical treatment of divisions of the earth's surface. These divisions may be large regions such as tropical Africa, or political divisions, or small areas like the San Francisco Bay area.

The instructor who wishes to guide his two or three hundred students into inten-

sive reference reading through assignment, or to tempt them into extensive supplementary reading by the suggestion of interesting books, often hesitates because of the paucity of satisfactory material. He might, for example, when discussing the rainy tropics, hope that his students would be inspired to read about the Congo, Nigeria, and other wet tropical lands of current importance. He knows, however, that if awakened interest leads the students to the library, they will find spectacular picture stories in the illustrated magazines, and thousands of words in other periodicals about political situations, but little that deals with the geography of these areas.

If given a specific assignment in the geography of some part of the rainy tropics, the students will have to compete for the privilege of using Kimble's *Tropical Africa (1)* and other valuable scholarly works on these areas. It is clearly impossible for all of the hundreds of beginning students to examine such few books, let alone read them. Few college libraries provide multiple copies in sufficient quantity for such wide use.

Fortunately, the number of sound, scholarly books and articles concerning, or related to, geography is increasing at an accelerated rate of publication. The enlarged book review sections in *The Professional Geographer* and other geographic periodicals reflect this trend. If the trend continues, and the number of books published each year exceeds by a great enough margin those that become obsolete, the amount of geographic reading material may eventually meet instructional needs.

Types of supplementary reading materials. Among the new books, we are pleased to find an increasing number dealing with regions. The instructor is grateful for *Tropical Africa*, as well as Cressey's *Crossroads (2)*, Church's *West Africa (3)*, and other current regional studies. However, there is a regrettable lack of books that treat smaller parts of the world in greater detail. A thick two-volume work on tropical Africa is invaluable, but a single volume on the geography of the Congo is needed. Books on many other areas and aspects of geography would be equally welcome. When the subject matter is limited to one topic, or to a relatively small part of the world, such books can be descriptive as well as statistical, and can be written with color as well as with clarity.

Supplementary reading materials should differ in character as well as in type of subject. Scholarly articles and books must be included if the student is to learn what is recognized by geographers as sound scholarship, and if he is to become familiar with the geographic approach, treatment, and point of view.

On the other hand, some not-so-scholarly writings are needed to give the student the atmosphere of far-off lands. The lighter literature of travel and adventure often contributes flavor and color that kindles interest and builds understanding. For example, where is there a better description of heat and drought than in the detective story, *Death of a Lake (4)*, by Upfield, in which the narrative follows the events at an Australian sheep station located near a playa as the characters wait anxiously for the lake to dry up and expose the skeleton that will solve the mystery?

Might we have some less-technical books by outstanding geographers? In the past, geographers, jealous of their reputations as scholars and protective of geography as a science, have hesitated to produce anything but staid and sober works. They have written only solid geography for their colleagues or for earnest students.

Let us hope that some of the Fulbright scholars and other geographers who spend time abroad will publish not only scientific reports but, in addition, highly personalized records of what they saw and did and learned. Geographers are trained observers. Their approach to a land and its people would give their accounts a breadth and understanding seldom found in books of travel and adventure. Not every geographer could be expected to produce a *Journey Without Maps (5)* or a *Bafut Beagles (6)*, but a few surely do possess enough literary skill to write travel books that would be delightful and absorbing as well as accurate and penetrating.

There is, without question, a shortage of all kinds of books and articles needed for the student in introductory geography classes. No doubt the diligent professor who spends many hours searching book reviews, scanning library shelves, and reading can make up lists of suitable references. This achievement, however, does not solve all of his difficulties; there remains the major

problem of supply. Few college libraries are equipped to meet the demands of large numbers of students, especially if the instructor has been successful in arousing their interest in a particular topic.

The paperback as a supplementary source. The geography instructor who has been frustrated in his attempts to provide reading materials for his classes cannot help but notice that students coming into his classroom carry, among other books, small bright-jacketed paperbacks that they are using in their literature, history, and science courses. He observes, with envy, copies of *Anna Karenina (7)*, *The Oregon Trail (8)*, *Science and the Modern World (9)*, and many other examples of the excellent, yet inexpensive, paperbacks now flooding the college market.

This tidal wave of paperbacks has yielded only a few books written by recognized geographers. Penguin has published *Geography of World Affairs* by Cole *(10)*, and Mentor has included *Mainsprings of Civilization* by Huntington. *(11)* But paperbound books such as *Case Studies in World Geography*, edited by Highsmith *(12)*, and *The Nature of Geography* by Hartshorne *(13)*, are not in the same category as the inexpensive and easily available pocket-sized paperback.

Some paperbacks now in print can be used for geographical enrichment or background reading. Among these, a few are of special value and may even be considered classics of their kind. These include books of travel and adventure such as Van der Post's *Venture to the Interior (14)*, Greene's *Journey Without Maps*, and an abridgement of Doughty's *Travels in Arabia Deserta. (15)* Unfortunately, each of these sells for more than one dollar. Among the less expensive paperbacks are *Nautilus 90 North (16)*, *Tiger of the Snows (17)*, and *Annapurna. (18)* A recent addition to exploration literature in paperback form is *Andree's Story (19)*, one of a series called Explorer Books.

A few paperbacks in the fields of history, anthropology, and science can be of use to the undergraduate student of geography. Fortunately, Webb's *The Great Plains (20)* is available in paperback, although in an edition priced above one dollar. A biology, *The Forest and the Sea* by Bates *(21)*, includes excellent descriptions of rain forest, savanna, and desert. Among others in these fields which are worthy of mention are *The Island Civilizations of Polynesia* by Suggs *(22)* and *Christopher Columbus, Mariner* by Morison. *(23)*

Of course, other paperbacks of greater or lesser value could be mentioned, although even a complete list would not be long. A search of each new Paperback Review and of each Paperback Book Section in the *New York Times* results in the addition of only a few relevant titles.

An examination of the bibliography, *Africa in Paperbacks (24)*, brings a similar disappointment. This publication lists all "relevant, serious adult books" available at the time of publication, May 1960. Under the section titled Geography are seven books, three of them atlases. Some of the other sections include publications of the Food and Agriculture Organization, and of the United Nations, but few are inexpensive and some sell for as much as three dollars.

Increasing the supply of geographic paperbacks. We can only speculate as to the reasons why the number of paperbacks of value to geography students is so comparatively small. No doubt books of this type would be printed in greater abundance if the publishers could foresee a large enough market to bring an adequate financial return. Most of us know from experience that publishers hesitate to produce geography books unless they can be sold as textbooks and thereby gain a share in the educational market.

The unwelcome throught comes to mind that there may be little geographic writing with enough appeal in style and subject to attract the general reading public. We prefer to believe that the paperback publishers are woefully ignorant of this important field and that they do not recognize the possibilities in geographic publication.

The inexpensive paperback may be the solution to the problem of providing enough suitable reference and enrichment reading materials for the large introductory college classes in geography. If this idea has merit, it would be worth while for geographers to make an effort to increase the number of suitable paperbacks available.

Perhaps there is someone among us who knows the paperback business and who could become associated in an advisory capacity with one of the publishing companies. This person could aid in the selection of suitable classics on travel, explora-

tion, and adventure. Such books would command a large market and also be of value to students. This same person might also edit anthologies, collecting some of the best geographic writing as has been done for geology in *The Crust of the Earth. (25)*

Another avenue of approach would be for a joint committee of the Association of American Geographers and the National Council for Geographic Education to prepare a list of books that it would recommend as suitable for paperback reprints.

A further possibility would be for such a committee to plan and supervise the preparation of original manuscripts for inexpensive editions, as was done by a group of physicists and high school teachers organized as the Physical Science Study Committee. The efforts of this committee have brought about the Science Studies Series, which includes books offering a fresh approach to the study of physics. The financial aid given to this project by several foundations suggests that similar support might be found for a well planned series in geography.

Conclusion. In short, this article emphasizes the importance of providing supplementary reading materials for college students in introductory geography courses. It acknowledges the difficulty in locating rich and varied materials on geographic subjects in great enough supply for the hundreds of students enrolled in introductory classes in many colleges. Further, it suggests that geographers should not confine their writings to generalized college textbooks, but should write more graphic and colorful works on limited topics and small areas. It proposes that inexpensive paperback books on sound, timely, and interesting geographic subjects could be of great value, and that geographers should take steps to increase the number of such books.

Such an increase in the amount and availability of good geographic writing not only will serve college students, but will stimulate the interest and advance the geographical knowledge of the general reading public.

If all of this comes to pass, the traveler at the air terminal newsstand will reach across the latest paperback mystery to select a geographic description of the territory over which he is about to fly. The nurse, the businessman, and the housewife will search the racks at the drugstore for interesting and illuminating paperbacks on the geography of Cuba, the Congo, or Greece. Moreover, the college teacher will note with satisfaction the presence of bright-jacketed geographies in the armloads of books carried into the classroom by his students.

° ° °

(1) Kimble, George H.T., *Tropical Africa*, The Twentieth Century Fund, New York, 1960. 2 Vols.

(2) Cressey, George B., *Crossroads: Land and Life in Southwest Asia*, J. B. Lippincott Co., Chicago, 1960.

(3) Church, R.J. Harrison, *West Africa: A Study of the Environment and of Man's Use of It*, Longmans, Green and Co., Inc., New York, 1960.

(4) Upfield, Arthur W., *Death of a Lake*, published for the Crime Club by Doubleday and Co., Inc., Garden City, 1954.

(5) Greene, Graham, *Journey Without Maps*, The Viking Press, New York, 1961.

(6) Durrell, Gerald M., *Bafut Beagles*, The Viking Press, New York, 1954.

(7) Tolstoy, Leo, *Anna Karenina*, Modern Library, Inc., New York, 1950.

(8) Parkman, Francis, *The Oregon Trail*, New American Library of World Literature, Inc., New York, 1961.

(9) Whitehead, Alfred North, *Science and the Modern World*, New American Library of World Literature, Inc., New York, 1959.

(10) Cole, J.P., *Geography of World Affairs*, Penguin Books, Baltimore, 1959.

(11) Huntington, Ellsworth, *Mainsprings of Civilization*, New American Library of World Literature, Inc., New York, 1959. Mentor Books.

(12) Highsmith, Richard M., Jr., ed., *Case Studies in World Geography: Occupance and Economy Types*, Prentice-Hall, Inc., Englewood Cliffs, N.J., 1961.

(13) Hartshorne, Richard, *The Nature of Geography*, Association of American Geographers, Washington, D.C., 1939.

(14) Van der Post, Laurens, *Venture to the Interior*, The Viking Press, New York, 1961.

(15) Doughty, Charles M., *Travels in Ara-*

bia Deserta, Doubleday and Co., Inc., Garden City, 1955. Abridged.

(16) Anderson, Cmdr. William R., *Nautilus 90 North*, New American Library of World Literature, Inc., New York, 1959.

(17) Ullman, James Ramsey, *Tiger of the Snows*, Bantam Books, New York, 1956.

(18) Herzog, Maurice, *Annapurna*, Popular Library, New York, 1960.

(19) *Andree's Story*, The Viking Press, New York, 1960.

(20) Webb, Walter Prescott, *The Great Plains*, Grosset and Dunlap, New York, c. 1931.

(21) Bates, Marston, *The Forest and the Sea*, New American Library of World Literature, Inc., New York, 1961.

(22) Suggs, Robert C., *The Island Civilizations of Polynesia*, New American Library of World Literature, Inc., New York, 1960.

(23) Morison, Samuel Eliot, *Christopher Columbus, Mariner*, New American Library of World Literature, Inc., New York, 1956.

(24) Kelley, Douglas C., *Africa in Paperbacks: 199 Paperbound Books on Africa South of the Sahara*, Michigan State University, East Lansing, 1960.

(25) Rapport, Samuel and Wright, Helen, eds., *The Crust of The Earth*, New American Library of World Literature, Inc., New York, 1955.

AMERICAN GEOGRAPHERS: A CRITICAL EVALUATION

C. W. Thornthwaite

Soil Conservation Service

The following article, prepared in December of 1939, was sent to the editors by Richard Hartshorne and is printed verbatim, except for minor editorial style changes, with the permission of the author. Hartshorne's covering letter reads in part as follows: "In view of the statistical studies of American geographers in your current [May, 1961] number, you may be interested in a similar [unpublished] paper written twenty years earlier . . . [which] was seen only by a few privileged individuals. This 'classic in statisticospoofery', as John K. Wright says in a recent letter, 'is on a par with Parkinson's Law.' Publication now in **The Professional Geographer** would indicate to your readers what attention to pay to the pieces in the current number."

A RECENT critical survey of current geographic thought is of unusual interest to all American geographers because it supplies a basis not only for a general evaluation of American geographers but for definite ranking of individual geographers as well. There has, in the past, been great uncertainty as to the relative worth of the various members of the Association and consequently a scientific method which can be depended upon to remove this uncertainty is extremely welcome. The method herewith presented is based on the theorem: "By their works ye shall know them."

The works of the American geographers have been critically surveyed. From the index of authors the number of citations in the text can be determined. This number is taken as a rating index on the assumption that the more important geographically a man's contribution is, the more numerous will be the references to his work. Conversely, if a man is not mentioned at all it indicates either that he is not a geographer or that his work is worthless.

The ratings of individual geographers, then, supply an invaluable basis for rating geography departments in the various universities and geographers in the government and elsewhere. In Table I is presented the individual ratings of American geographers, and in Figure 1 the ratings of the individual members of the staffs of university departments of geography.

A number of interesting things are shown by this analysis. Of great significance is the pattern of distribution of grades of the staff members of the various departments. The distribution pattern indicates that some departments are reasonably homogeneous. For instance, at Chicago all members are mediocre and at Clark half are low morons and half are idiots. This is in marked contrast to conditions in Minnesota where two morons and one low mediocre are in the same department with a genius. In Michi-

TABLE I

INDIVIDUAL RATINGS OF AMERICAN GEOGRAPHERS

Geographer	*Rating*[1]	*Geographer*	*Rating*[1]
R. Hartshorne	45	S.B. Jones	2
V.C. Finch	43	J.R. Whitaker	2
C.O. Sauer	43	E. Ekblaw	1
P.E. James	34	O. Schmeider	1
J.O.M. Broek	24	H. Shantz	1
D. Whittlesey	23	G.-H. Smith	1
G.T. Trewartha	23	L. Thomas	1
J.B. Leighly	21	W.W. Atwood	0
W.D. Jones	19	C.P. Barnes	0
C. C. Colby	16	C. Batschelet	0
R.S. Platt	15	C.H. Behre	0
W.M. Davis	15	H.H. Bennett	0
S.N. Dicken	12	C. Birdseye	0
H.H. Barrows	11	S.W. Boggs	0
R.B. Hall	11	C.F. Brooks	0
E. Huntington	11	F.A. Carlson	0
S.D. Dodge	9	W.H. Hobbs	0
O.E. Baker	8	C.F. Jones	0
I. Bowman	8	C. Kellogg	0
N.M. Fenneman	8	J.B. Kincer	0
F.B. Kniffen	8	C. Marbut	0
J.K. Wright	8	R. Peattie	0
R.H. Brown	7	R.J. Russell	0
R.E. Dodge	7	L. Schoenmann	0
E.C. Semple	7	J.R. Smith	0
R.H. Whitbeck	7	V. Stefansson	0
D. Johnson	6	E.N. Transeau	0
A.E. Parkins	6	R. Vance	0
G. Taylor	6	E. Van Cleef	0
S. Van Valkenburg	4	J.O. Veatch	0
G.B. Cressey	3	S.S. Visher	0
D.H. Davis	3	O.D. Von Engeln	0
M. Jefferson	3	H. Wilkins	0
W.L.G. Joerg	3	H.C. Willett	0
K.C. McMurry	3	B. Willis	0
C.W. Thornthwaite	3	C. Wissler	0
W.H. Hass	2	L.A. Wolfanger	0
		G. M. Wrigley	0

[1]Definitions: 41-50, Genius; 31-40, Superior; 21-30, Good; 11-20, Mediocre; 1-10, Moron; 0, Idiot.

gan and Wisconsin the situation is similar but not so extreme. In California there is a wide range with two good, and one genius counterbalancing one low moron. Table II shows the comparative rank of the principal geography departments in the United States.

A serious defect in departmental organization at a number of universities is revealed. At Chicago, Clark, Louisiana, Michigan, and Minnesota the chairmen are the lowest in rank of the staff members of the geography departments. Most conspicuous is the situation at Minnesota, where a man of grade 45 is supervised by one of grade 3. It might be pointed out in passing that of the three members who are or have been university presidents, two are morons and one is an idiot. It is probable that these anomalies have developed because there has never been in the past a reliable rating of geographers available. It is to be expected that now a redistribution will occur and those qualified to lead will lead.

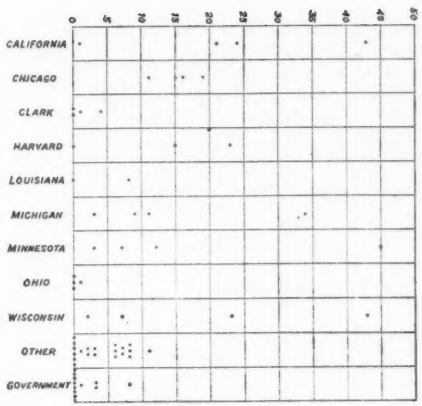

FIG. 1. Distribution of ratings of geographers in the American universities.

The fact that the geographers in the government service consist solely of morons and idiots with a preponderance of the latter, explains why no work of any value can come from government departments, and also illustrates a form of natural selec-

TABLE II

COMPARATIVE RANK OF THE PRINCIPAL GEOGRAPHY DEPARTMENTS IN THE UNITED STATES

Geography Department	*Rank*
California	22
Wisconsin	19
Minnesota	17
Chicago	15
Michigan	14
Harvard	13
Louisiana State	4
Clark	1
Ohio State	0

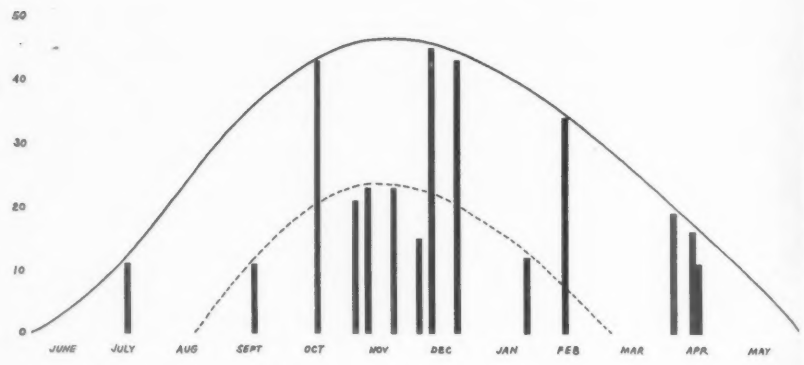

FIG. 2. Birth dates of certain American geographers.

tion which has been discussed in a presidential address before the Association. The fact that there are still a few morons and idiots in university departments indicates that the process of selection has not yet run to completion. It is to be expected that eventually all of these will be in the government service.

The season and year of birth of the geographers receiving a rating of 10 or higher are shown in Figure 2. Those born in odd-numbered years are outlined by the solid line and those born in even-numbered years by the dashed line. A few geographers have been shown on this basis to have reported their year of birth erroneously. For instance, John Leighly reported his birthday as November 6, 1895, where Figure 2 clearly demonstrates that he was born in an even-numbered year. If he had actually been born in 1895 he could have been a genius with a rating higher than any now existing. The best time to be born a geographer is shown to be November 20th in an odd-numbered year. It was a great misfortune that Trewartha was born November 22, 1896, rather than in some odd-numbered year.

A number of geographers who rate only as morons and idiots have actually reported their birthday as in November or in other autumn or winter months. A casual inspection of Figure 2 will show that such reports are obviously erroneous and fictitious, since it is shown that no one with a rating below 10 could have been born between September 15th and February 10th in an even-numbered year or between July 10th and April 30th in an odd-numbered year.

It is gratifying to find that we have among the geographers themselves a complete verification of the thesis, well-known in geographical and astrological lore, that a child's future is determined by his birthday.

In conclusion, the author wishes to emphasize that because of their great value the ratings included in this paper should be disseminated as widely as possible. Particularly should they be placed in the hands of prospective geography students who, through ignorance or through malicious propaganda, might otherwise make a mistake in the choice of school and professor.

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ADDENDUM

Readers may be interested in seeing the correspondence associated with submittal and acknowledgment of the original manuscript in 1939. An edited version follows.

December 16, 1939

Dr. Preston E. James,
Department of Geography,
University of Michigan,
Ann Arbor, Michigan

Dear Jimmy:

I appreciate that there is little likelihood that space can still be found on the Chicago program for a paper. However, I am sending you a copy of a paper only recently completed and request that you examine it. It will probably be classed as systematic geography rather than chorography.

Sincerely,

C.W. Thornthwaite, Chief
Climatic and Physiographic Division

December 20, 1939

Dr. C. Warren Thornthwaite,
Soil Conservation Service,
Washington, D.C.

My dear Warren:

I am very sorry that the program for the Chicago meeting has already gone to press and it is too late to include your valuable contribution . . .

Your illuminating comments which bring to light falsification of birthdays might also be extended to a geographical study of distribution. I am sure you would find that all the outstanding geographers were born, or at least conceived, at a temperature not far from 65°F. And further, that they have spent most of their productive lives at an average temperature of the warmest month of 71.7°. This of course would not be brought out by reference to the Thornthwaite system, but does appear from a study of Koppen. . . .

There are those also who will question the logic of arranging the idiots in alphabetic order. I personally would be in favor of using inverted alphabetic order.

Was this [study] done on government time? I see no mention anywhere of research funds having been granted to carry through the statistical work involved. I believe the whole thing would be made more valuable if there was some reference in a footnote of source of funds.

I look forward to having a beer with you.

Sincerely,

Preston E. James

IMPORTS, INDUSTRIALIZATION, AND THE ECONOMIC GROWTH OF LESSER DEVELOPED COUNTRIES

Morgan D. Thomas

University of Washington

THERE APPEARS to be a growing interest among geographers in the problem of effecting economic growth in lesser developed parts of the world. An expanding body of geographical literature on the subject attests to this interest. *(1)* Governments of lesser developed countries, in general, are anxious to promote economic expansion in order to provide material means for raising levels of consumption among their people. Geographers are well aware of the diversity in areal distributions of natural and cultural resources, and consequently realize that uniform patterns of economic development are not to be expected in all countries.

Various writers have shown that economic growth, as indicated by an increase in per capita income, "is normally accompanied by a rise in the share of industrial output." *(2)* The usual explanation given for such an association is that changes in income elasticity of demand for food products, in an economy where per capita income is rising, result in a decline in the share of food as part of total consumer demand. There are, of course, concomitant shifts in the composition of demand in favor of outputs from secondary and tertiary industries.

This paper presents a brief examination of one method of effecting industrialization within a lesser developed country, assuming that the country chooses this means as the most desirable way of raising per capita income. A basic premise of the analysis below is the employment of economic development planning within the country attempting industrialization.

Industrialization. If a lesser developed country seeks to industrialize as fast as possible, despite possibilities of better comparative returns through investment in selected agricultural sectors, what are some of the items that should be considered in formulating a program for growth of manufacturing activities? Obviously, the program should be drawn up within the framework of economic and social objectives of the country concerned. Moreover, decisions would have to be made as to whether the balanced or the unbalanced growth approach should be used, since many factors influence the choice of industries which will receive the greatest support. *(3)* Then, too, consideration should be given to the possibility of keying industrial expansion to the foreign import situation of the country. It is this latter item, namely the role of import substitution as a factor influencing industrial growth and as an economic development planning tool, that forms the theme of the remainder of this study.

Geographers and trade. Geographers have long been interested in trade. Perhaps in recent years members of the profession have not devoted as much specific attention to the field as they once did. However, there is now evidence of a revival of interest in the subject, and there is certainly an improvement in quality of some of the work dealing with regional, interregional, and international exchange of goods. *(4)*

Studies by geographers have tended to emphasize the flow patterns of trade, and the commodity composition of exports and imports. Attention in some cases has been given to the complementarities of trade between areas with different levels of technologies. In other words, geographers have been primarily concerned with the areal aspects of exchange, and the nature of trade linkages.

A few geographers also have attempted to indicate the possible economic impact of trade on the economies with which they were concerned. In the main, these works provided statistical measures, such as the value of exports and imports and the proportion of national income accounted for by trade. Many geographers, however, apparently felt that the economic impact of trade on various kinds of economies should be studied only by economists.

In contrast, the present writer believes that geographers can and should contribute to the study of the various economic ramifications of trade. He proposes to demonstrate how some of the data commonly assembled by geographers in their trade studies may be used for analyzing certain facets of the process of industrialization, and how such analyses can contribute to a program of industrial development.

Import substitution. Most studies which focus on the role of trade in promoting economic growth in a region stress the contributions of exports. In fact, North, a proponent of the export base theory of economic growth, states that "the timing and pace of an economy's development have been determined by: (1) the success of its export sector, and (2) the characteristics of the export industry and the disposition of the income received from the export sector." *(5)* Even though one may not wish to concur fully with such an extreme view, there is little doubt that exports play an important part in the economic growth of most countries, and perhaps a crucial role in the case of certain parts of individual countries.

Less attention is given in the literature to the significance of import substitution as a contributor to economic growth, and as an indicator of possible new fields of development. One may, however, on *a priori* grounds suspect that import substitution can contribute to economic growth and industrialization. The reasoning is along the following lines. In a growing economy there is a rise in effective demand. Given such a condition, "an increasing number of products, formerly imported, may be produced at home as soon as a sufficient volume of sales are reached by a plant of optimum size." *(6)* Recent work by Chenery supports the thesis that import substitution is a significant factor which influences the nature, direction, and rate of industrial growth. For example, in Japan between 1914 and 1954, it is found that "import substitution accounted for nearly 40 per cent of the rise of industry as compared to less than 10 per cent for exports." *(7)*

Of course, it is reasonable to expect that the influence of import substitution will tend to vary through time and from country to country. A greater accumulation and evaluation of suitable data are necessary at this stage if we are to have a more accurate and precise idea of the relationship between such substitution and industrial growth. Geographers may, for example, establish relevant associations between growth and/or decline trends in various kinds of imports, and growth and/or decline trends in industries using such imports as raw materials or producing substitutes for finished product imports. Chenery outlines a model which may be used for such analytical purposes. *(8)* Where correlations are high, other techniques of analysis may be used to check for possible causal connections between trends in certain imports and growth patterns for selected industries.

Imports and industry studies. Let us assume, for purposes of this paper, that import substitution is a significant factor influencing the character of industrial growth. If such be the case, we may briefly analyze selected aspects which condition the usefulness of import substitution as a means of effecting industrial growth in a specific

region. First, however, it must be understood that import substitution is but one of many complementary ways of achieving such an objective.

One may begin by analyzing the region's imports as to their nature and magnitude. Industries are then chosen for study according to their possible establishment for purposes of producing substitutes for selected imports. The initial selection of such industries requires a knowledge of production costs at various levels of output, and an assumption as to expected sales of various classes of goods. In this way considerations may be given, in the selection of industries, to demand and supply aspects of the question. *(9)*

After initial selection of industries is made, then more intensive studies are carried out to examine the feasibility of their establishment within the constraints of the industrial development program of the region concerned. *(10)* In a paper of this kind, it is not feasible to examine the nature of such constraints. Neither is it possible, or desirable, to make a comprehensive analysis of various factors which will condition the final choice of industries which appear to have a good chance of being successfully established as producers of substitutes for selected imports. However, it is assumed that a *brief* survey of selected factors which influence the final choice is of value in so far as the discussion may indicate ways in which geographers can contribute to this field of study.

Supply. On the supply side, the feasibility of establishing a new industry is markedly influenced by such factors as economies of scale, comparative costs of production, and location. Geographers have long contributed data and insights on these topics.

The knowledge that an industry has interdependence linkages with suppliers of inputs and with purchasers of its outputs also has a bearing on the feasibility of establishing an industry. A growing number of geographers is aware of the usefulness of input-output analysis in this connection.

Industrial complex is another technique used by some geographers which takes into account the relevance of industrial interdependences. The use of this technique is a recognition of the fact that decisions connected with establishment of a plant or industry should not be made in isolation. Numerous recent studies have indicated the importance of such interdependence linkages as generators of industrial growth and structural change. *(11)*

Demand. It is also evident from a study of geographical literature that there is growing interest by geographers in certain aspects of demand. Market studies of various kinds, produced by members of the profession, support such an observation.

Before a new good is produced, it is obviously desirable to obtain some indication of what sales may be expected. Consideration must be given to home and possible foreign markets for the output. Market estimates should take into account the effect of rates of growth of national and per capita income, as well as income distribution among different income classes.

Data on demand for final consumer groups are generally obtained from three sources: (1) family budget statistics, (2) retail trade observations, and (3) calculations relative to production, imports and exports, and, where applicable, changes in stocks. There are a number of well known works which examine these sources of data and which discuss problems connected with their evaluation and use. *(12)*

With respect to foreign trade, it is said that "no other branch of economic activity can boast a documentation so detailed, so comprehensive or in such long unbroken series." *(13)* Data on imports and exports are available for economically advanced as well as many lesser developed parts of the world. Of course, when market estimates are made for particular products in selected lesser developed countries, there may well be a paucity of information on patterns of demand for such areas. In these instances, the "art of such an analysis is to find figures that cover the most comparable groups of people in other countries" together with the application of "common sense." *(14)*

Summary. The substitution of domestic production for imports is suggested as one way of effecting industrialization. Geographers have long been studying various aspects of trade and industrialization. In this paper, an attempt is made to outline briefly ways in which their interests, and some of their work, on these topics can contribute to a greater understanding of the process of industrialization, and to the

achievement of a higher economic level in many lesser developed parts of the world.

* * *

(1) See, for example, Ginsburg, N., ed., *Geography and Economic Development*, University of Chicago Press, Chicago, 1960, especially pp. ix-xx; Ginsburg, N., *Atlas of Economic Development*, University of Chicago Press, Chicago, 1961.
(2) Chenery, H.B., "Patterns of Industrial Growth," *The American Economic Review*, Vol. L, No. 4, 1960, p. 624.
(3) For a brief review of some of these factors see Thomas, M.D., "Programming, Industrial Interdependences and Economic Development," *Business Review*, University of Washington, College of Business Administration, Vol. XX, No. 1, 1960, pp. 48-57.
(4) See Alexander, J.W., "International Trade: Selected Types of World Regions," *Economic Geography*, Vol. 36, No. 2, 1960, pp. 95-115; Morrill, R.L. and Garrison, W.L., "Projections of Interregional Patterns of Trade in Wheat and Flour," *Economic Geography*, Vol. 36, No. 2, 1960, pp. 116-126; Ullman, E.L., *American Commodity Flow*, University of Washington Press, Seattle, 1957.
(5) North, D.C., *The Economic Growth of the United States, 1790-1860*, Prentice-Hall, Englewood Cliffs, 1961, p. 1.
(6) Tinbergen, J., *The Design of Development*, The Johns Hopkins Press, Baltimore, 1958, p. 18.
(7) Chenery, *op. cit.*, p. 651.
(8) Chenery, *ibid.*, pp. 625-644.
(9) Tinbergen, *op. cit.*, pp. 16-18.
(10) Thomas, *op. cit.*, pp. 49-50, 53-56.
(11) See, for example, Chenery, H.B. and Watanabe, T., "International Comparisons of the Structure of Production," *Econometrica*, Vol. 26, No. 4, 1958, pp. 487-521; Isard, W., *Methods of Regional Analysis*, Wiley, New York, 1960, chs. 7, 8, 9.
(12) Tinbergen, *op. cit.*, pp. 20-21.
(13) Yates, P.L., *Forty Years of Foreign Trade*, Macmillan, New York, 1959, p. 16.
(14) Tinbergen, *op. cit.*, pp. 16-17.

SOME USES OF AERIAL PHOTOGRAPHS IN URBAN ANALYSIS

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AERIAL photographs are being used with increasing frequency for many types of spatial analyses. Their position in geology, soil evaluation, engineering, forestry, and numerous other fields is well entrenched. However, use of air photos in urban geography and city planning has scarcely been developed beyond the embryonic stage. The purpose of this paper, therefore, to is indicate a few of the many ways in which aerial photographs can serve as an invaluable asset to the urban geographer and city planner.

Preparation of urban base maps. Probably the most basic use of air photos in urban analysis is in furnishing information for the preparation of base maps. A perfectly acceptable base map, for many purposes, can be made by tracing directly from the photographs. When using this method, it is desirable to employ prints with a scale of at least one inch to four hundred feet. This enables the draftsman to locate with relative accuracy the center lines of streets, and sometimes the right-of-way lines as well.

The direct tracing method is sometimes not as satisfactory as might be desired, since photographic distortion, poor photography, substandard printing, and lack of clearly marked survey points may make measurements more a matter of judgment than of exactness. Nevertheless, lack of an alternative base map, or a badly confused earlier platting, may render even a somewhat inaccurate direct-tracing photo base map a serviceable and low cost tool for the urban analyst. The alternative, i.e., preparation of a base map in the conventional manner by constructing a grid of section lines and plotting from the plats of record or from metes and bounds de-

scriptions, would necessitate much time and expense.

After the basic outline map is prepared, lot lines can be added from what platting is available. Any reasonable discrepancies in measurements can be distributed throughout a block, so as to eliminate serious error in a single lot. This manipulation is not objectionable, as it tends to give a fairly accurate representation that is usable for normal work.

The direct tracing method of base map construction is most valuable when dealing with areas having no subdividing. In such a situation it is common practice to turn to records of the tax assessor, but this is an extremely time-consuming procedure. Using photos, the locations of properties can be plotted with some degree of accuracy and can be later checked in the field by pacing. The quality of control attained in this manner will be exceeded only by that achieved through use of a plane table or a transit.

Preparation of a base map by the above method may have its shortcomings, but it is a quick, simple, and inexpensive method of mapping an urban area in which control and previous mapping are below par.

Analysis of urban growth trends. One of the major areas of study for urban analysts is concerned with the patterns and rates of urban growth. Aerial photographs can serve as a most useful tool for such work. A study of this nature must be undertaken, of course, with quite a supply of photographs ranging over a period of years.

Questions as to the direction of growth, types of development, rate of growth, increase in dwelling density, expansion of the city's dominance area, and many others can be answered by analyzing air photos taken at regular intervals. In a sense, the photos comprise a pictorial history of recent development within and contiguous to the city.

Comparisons can be made between conditions existing during several different stages in a community's recent history. It may even be possible to go as far back as twenty-five years into the past by using old military and Department of Agriculture photographs. Unfortunately, aerial photography was not common until shortly before World War II.

This handicap is not as serious as it may seem, for many of the nation's smaller communities, in which previous information pertaining to this subject is most often lacking, frequently experienced most of their growth during and after the Second World War. Since that time, these towns have more than likely been photographed periodically by one or more agencies of the Federal Government. Hence, their recent growth trends are clearly represented.

Analysis of urban structure. By the use of air photos, a clear comprehension of the structure of a town can be obtained. An examination of facts recorded on photos will do much to facilitate the classification of a community as one of three major morphological types, i.e., concentric ring, sectoral, or multiple nuclei, or a combination of these classes.

Careful interpretation of photographs can delineate functional units of a community. Such distinctive areas as urban residential, industrial, central business district, blighted neighborhoods, and suburban neighborhoods are easily located. However, detailed land use studies should not be attempted in this manner without supplementary field work.

Whereas preparation of a detailed land use map of a whole town from aerial photographs is impracticable, the relationships of a surrounding neighborhood to a particular proposed new urban facility with a specific use can often be determined satisfactorily from air photos alone. For example, the effects of an impending shopping center on the immediately surrounding area can be more clearly seen on aerial photographs than on the usual land use map, since the photos furnish a more comprehensive assemblage of facts and can give much insight into the social ecology of the neighborhood. The use of air photos in a situation such as this may prevent a quiet residential street from becoming a throughway. Similarly, the location of new off-street parking facilities and the solution of existing traffic problems can be aided by using photographs taken at different times of the day.

Analysis of urban space utilization. In the more congested parts of town it is often wise to analyze the utilization of space by buildings. Aerial photographs can be most helpful in this type of survey. It is a simple matter to trace the location of buildings from a large scale photograph

onto some type of transparent drawing medium. The scale of the tracing can then be modified by photographic methods. Lot and/or property lines should be added to the drawing, so as to give a more accurate representation of space utilization conditions.

This method allows the urban analyst to calculate the percentage of each lot covered by buildings. Granted, this may be done in the field, but the number of ground measurements needed to locate the buildings on their respective lots would be considerable, and the time and expense involved would be unnecessarily great.

A building map of this type can be of considerable value in studying urban housing conditions. It is an easy matter to note on the map such variables as dilapidation, obsolescence, number of dwelling units, race of occupants, and so forth during a brief foray into the field. All such items can be indicated within the outlines of the buildings by the use of a suitable fractional or decimal code.

Analysis of the urban hinterland. Using aerial photographs, the urban community can be studied not only as a self-contained entity but also in relation to its setting within its hinterland. This procedure will involve the use of possibly several flights of air photos; hence, the best way for the urban analyst to gain a valid comprehension of the over-all patterns of cultural relationships is by use of a semi-controlled mosaic. Such a mosaic will enable the urban geographer to draw many conclusions that would not be possible by using maps alone, since air photos show the landscape in its entirety.

This method of attack is excellent when studying the feasibility of annexing or developing areas contiguous to municipal boundaries. It is also of great value in a preliminary survey of extra-urban transportation facilities, possible extension of usual community services, and the expansion of a public works program.

Concluding remarks. It would be wise for the urban analyst to accompany all of the above-mentioned uses of large scale aerial photographs with stereoscopic viewing of smaller scale photos. The third dimension adds much of value for the interpreter. To use photos in a two-dimensional manner only is to omit part of the story to be read from these valuable tools.

The use of aerial photography should prove helpful in conducting urban studies of many types. However, the full scope of urban photography cannot be delineated as yet. There remains much room for serious inquiry.

PRODUCTION, MARKETING, AND CONSUMPTION OF CATTLE IN EL SALVADOR*

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IN EL SALVADOR, as in most Central American countries, cattle are to be seen almost everywhere. When a plow is drawn, a harvest gathered, or when firewood, farm products, and water are transported, it is likely that oxen are employed. Herds of cattle may be clustered in the better pastures, scattered through scrubby range land and abandoned fields, or they may be grouped in droves along the highways and country roads. By and large, they are owned by people who regard themselves as dairymen as much as, or more than, producers of beef; but, in either case, interest in the stock is casual.

Production and trading of cattle are major phases of husbandry and of internal commerce in El Salvador. It is the purpose of this paper to portray details of such activities that may be of interest to geographers, and to evaluate prospects for change. Many of the conditions herein described are equally prevalent elsewhere in Central America.

The herd. There are more than 900,000 head of general purpose stock in El Salvador. These common cattle, the *raza criolla* or *raza india*, are bony long-horned animals that generally weigh about 600 pounds, al-

though mature bulls are a little heavier and oxen may weigh 900 pounds. The hair is short and predominantly brown or dun in color, but black appears about the eyes, muzzle, vent, and in the terminal knot on the characteristically short tail. When physical traits of European dairy breeds or of the Zebu are apparent, the cattle are designated *mestizas or mezclas.* In some herds such cross-bred cattle are improved stock, but breeding generally is haphazard, and promising results are lost through dilution.

Malnutrition, disease, and insects check productivity. All losses involved cannot be accurately measured, but a suggestion of the nature of the problem may be made. Malnutrition is responsible for sterility in 10 per cent of the cows and for a slow rate of sexual maturation, and contributes to the low (40 to 45 per cent) annual calving rate. Calf mortality rates of 35 to 40 per cent are the product of malnutrition as well as intestinal disorders, umbilical infections, and neglect. Mastitis and brucellosis are prevalent in a majority of herds. Few herds are free of tick or screwworm. *(1)*

Feed resources. Salvadoran cattle are maintained on some 1,730,000 acres of volunteer grassland, brush, and woods, and on 385,000 acres of improved pasture. Improved land, most of which supports milking herds, is apt to be irrigated or have a high water-table. Pasture and range lands account for about 40 per cent of the area of El Salvador. Another 20 per cent of the country is cropland where stock may be admitted following harvest. At best, pasture carrying capacity is one head per two and one-half acres. The range, which provides adequate feed in the wet season to support one head per two acres, deteriorates sharply during the winter dry season. Death is common during the seasonal drought, and survivors may be reduced to three-fourths of their wet-season weight.

Pasture and range units generally are large in size. Dry-season burning is common, but weed and brush control and rotation are not. The practice of cutting hay or silage is scarcely known, and use of cut green feeds or of supplements is limited to a few milking herds. Maize is reserved for human consumption. *(2)*

Cattle sources. An annual average (1954-1957) of 102,000 cattle are slaughtered in El Salvador with government knowledge. The major consuming area, central and western El Salvador, includes the departments of San Salvador, with 40 per cent of the slaughter; Santa Ana, with 12 per cent; Sonsonate, with 7 per cent; and La Libertad, with 7 per cent. This major consuming area, together with La Paz department, is primarily dependent upon cattle obtained from outside the region.

The major source area for market cattle is eastern and northern El Salvador, chiefly beyond the Rio Lempa, and also includes adjacent parts of Honduras and Nicaragua. Imported stock are primarily replacements for Salvadoran animals exported to Guatemala. On an average (1950-57), annual foreign traffic involves the entry of 24,100 head and the exodus of 25,200 head. The scale of contraband trade is unknown. Most movement is on the hoof, but railways transport some cattle at least part of the way to Salvadoran market places and to Guatemala.

Market cattle are drawn from milking herds and the reservoir of working or breeding animals. Cows and oxen, usually 10 to 14 years old, comprise 40 and 20 per cent, respectively, of the legal slaughter. Bulls, about half of them more than seven years old, provide another 11 per cent. Bullocks and heifers account for 20 and over 2.5 per cent, respectively. *(3)*

Assembly of market cattle. The weekly cycle of cattle traffic in El Salvador begins Monday to Wednesday with the sale of stock to *correteros* who call at the haciendas. From $30 to $100 is paid per head. Unmounted *campistros,* in the employ of buyers, drive the stock to a *plaza* or *tiangue* for resale on Thursday. Other buyers and drovers direct the cattle to the Saturday markets, and new groups carry on toward the Sunday market place near San Salvador.

The droves consist of from a dozen to several dozen head. They are driven day or night, with little allowance for browsing, rest, or watering. Since routes commonly follow main roads, the stock are exposed to recurring harassment by motor vehicles and by the agitated drovers. Such experiences contribute to dehydration and to foot and other injuries.

A roadside location, or a street or open area near town, may function as a market place on the sale mornings. Most sites are unimproved, but shade and water may be available. The markets at Santa Rosa de

Lima, Sensuntepeque, Puente Lempira, Nueva Concepcion, and Metapan are held on Thursday. The first three of these are tributary to San Salvador; the latter two serve the town of Santa Ana. Saturday markets at San Miguel and San Rafael Cedros are attended by dealers who sell in San Salvador. Their cattle are moved toward the capital's laboring class suburb of Mejicanos for the Sunday market. San Miguel stock are shipped by rail. Cattle from San Rafael Cedros and the north move on the hoof; about six to ten miles outside of the capital the droves are rested briefly and watered.

Nearly half of all cattle slaughtered pass through the Mejicanos market. They arrive in poor condition. Weight losses are considerable *(4)*, hides are apt to be ripped or raw, and hoofs may be worn and sore. Deterioration of meat quality is marked.

Cattle trading is for cash except at Mejicanos, where contractor-butchers buy only if the vendor defers payment for a week. Purchases are *al ojo*, by sight. From $80 to $120 is paid per head in the wet season, but prices may double in the dry season.

Destazadores and abattoirs. The contractor-butcher *destazador*, is cattle buyer, employer of butchers, and wholesale and retail meat vender. As many as half of a city's contractors may be women (32 of 60 in San Salvador). At work they may be aided by a husband, but the impression is that the women make the decisions and handle the purses. These women are readily distinguished at Mejicanos, where they appear in bright pastel or print dresses and are armed with parasols to ward off the sun or a stray animal. Some *destazadores* are considered to be people of affluence; as a group, they are suspected of price and competition control.

The more successful contractors in the capital include seven individuals, each of whom markets from 95 to 211 head per month. They control about 45 per cent of the city's total cattle trade. Their average net return is unknown, but a profit of $13 per head is reported in one local survey. Another 18 contractor-butchers, each handling from 30 to 95 head per month, account for an additional 35 per cent of the trade. The remaining 20 per cent involves 35 dealers who slaughter from 3 to 30 head monthly. *(5)* Most dealers in other towns fall into the low category.

Cattle are slaughtered in the abattoir of the *municipio* in which the meat is to be consumed. It is illegal to transport meat across township boundaries, and to slaughter cattle anywhere but in the abattoir. Thus, *municipio* revenues are maintained. The law also provides for animal and carcass inspection, but in practice the inspection is hardly more than a gesture. It is a rare animal that cannot become beef if the owner is persevering.

Except in San Salvador and Santa Ana, abattoirs have little to commend them other than that they are located on the periphery of towns. Typically they are small, poorly illuminated, unscreened structures of some antiquity. Tools, facilities, and techniques are rudimentary; and disposal of waste usually involves a rear wall, buzzards, and dogs.

Meat marketing. In major towns, vans and automobiles are employed to transport meat from abattoirs to retail outlets. Wheelbarrows are used at Mejicanos, and baskets are employed in all small towns. Basket carriers are used also in the redistribution of meat from central to peripheral town markets.

Most retail meat trade is conducted at stalls in public markets. Usually, these stalls are clustered in a specific section or building. Venders, all of whom are women, cap the social hierarchy of the market. They may be the contractor-butchers, their kin, or the womenfolk of male *destazadores*. In the cities, these women dealers often arrange with four or five *poquiteras* to sell meat for them in peripheral markets.

In the market stalls, meat is displayed upon concrete or galvanized metal counters or is draped from poles. The public may handle, pinch, and bargain over cuts. The meat may be weighed, but a practiced eye and hand are about as reliable as the scales. Except in the better grocery stores and butcher shops, refrigerated units are not used for display and storage.

A substantial amount of illegally butchered or transported meat is sold. An estimated 30 per cent of the meat consumed in the capital has been introduced surreptitiously. *(4)* Such traffic is understood to involve the better cuts for which only the cities provide a market, including institutional buyers and wealthy individuals.

Meat consumption. Considerable difference exists in estimates of annual per capita

meat consumption in El Salvador, since registry of slaughtered stock is incomplete and abattoir data are recorded by head rather than by weight. The Food and Agriculture Organization (1952-53) estimates consumption at 35 pounds. The Salvadoran census agency (1955) reports 28.4 pounds, of which 21.8 pounds are beef. Another estimate, based on abattoir weight samplings and a careful study of the industry, gives an annual per capita slaughter figure of 11.6 pounds of meat, two-thirds or more of it beef. *(6)* The last amount appears to be most reasonable. Whichever the figure, animal protein consumption is low. Furthermore, the national average embraces widely disparate levels of urban and rural consumption.

Conclusions. The level of productivity in the Salvadoran livestock industry is low. Annual recorded slaughter of cattle corresponds to about 11 per cent of the herd. Meat yield per head averages a modest 219 pounds; it grades commercial or lower. *(4)* Little or no attention is paid to preservation of wholesomeness.

Among agronomists, the view is accepted that upgrading of the livestock industry is essential if El Salvador is to feed its rapidly growing population at existing or improved levels. The expectation is that change can be accelerated with introduction of a price system based on unit quality and weight, and with construction of regional abattoirs or a central slaughter house. Direct involvement of the government in the marketing process is anticipated, because the climate of public opinion rules out large-scale private enterprise. Moreover, the central government has established a precedent by earlier entry into the business of gathering, storing, and marketing beans and grain staples.

The assumption is made that purchasing and abattoir innovations will provide incentives for ranchers to adopt essential improvements in management, feed storage, and breeding practices. The economies of larger scale slaughter house operations and of improved handling of hides, and returns from the capture of by-products from 100,000 head of cattle (and 185,000 swine) annually, are expected to be passed on to the producer and the consumer.

While it is essential that the mechanisms of production and marketing be altered substantially if El Salvador is to be better fed, it is doubtful that significant changes will occur soon. The whole chain of cattle and meat dealers is firmly forged by personal and trade relationships of long standing. Assuming that dealers are appeased into acceptance of change, there remains the problem of the cattle raisers. These people, who are landowners rather than husbandrymen, can be indifferent to the commitment of capital and direct managerial attention to a serious livestock program. Furthermore, public agencies are susceptible to becoming oriented to employee welfare rather than to public welfare. The outlook for drastic changes in the Salvadoran cattle industry within the near future, therefore, is not bright.

* * *

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(1) The foregoing facts are based on interviews with Mr. Robert Blodgett (Dairy Technician, Food and Agriculture Organization, San Miguel) and Dr. Carlos Meyer Arevalo (Jefe, Departmento de Sanidad Animal, Direccion General de Ganaderia, Ministerio de Agricultura, San Salvador). See, also, Choussy, Felix, *Economia Agricola Salvadorena,* Biblioteca Universitaria, Vol. XVIII, Edit. Ahora, San Salvador, 1950, p. 50.

(2) See Ranck, E. William, *The Meat Industry in El Salvador,* Republica de El Salvador, Ministerio de Agricultura y Ganaderia, Centro Nacional de Agronomia, Santa Tecla, M.S., 1953, p. 14; Jensen, K. Krusebak, *Informe al governo de El Salvador sobre la industria lechera,* Naciones Unidas, Org. de la Agricultura y Alimentacion, Informe No. 486 (FAO/56/6/4132; 1956), pp. 11-12; Choussy, *op. cit.*, p. 89; Castillo, Jose Roberto, *Reorganizacion de nuestras haciendas ganaderas,* Republica de El Salvador, Ministerio de Agricultura y Ganaderia, Direccion General de Ganaderia, Depto. de Sanidad Animal, Ponencia No. 14, Segundo Congreso

Pecuario Nacional, San Salvador, Junio de 1958, p. 1.

(3) Republica de El Salvador, Ministerio de Economia, Direccion General de Estadistica y Censos, *Anuario Estadistico*, 1954, pp. 249-250; 1955, Vol. I, p. 147, Vol. II, pp. 13, 28; 1956, Vol. I, pp. 186-187; 1957, Vol. I, pp. 240-241. See, also, *Boletin Estadistico*, II Epoca, No. 41, Enero-Febrero-Marzo de 1959, p. 64.

(4) Interviews with Dr. Carlos Meyer Arevalo; see Note 1, above.

(5) Data from *municipio* records. Estimated net return per head is based on a study of 248 head made by Dr. Carlos Meyer Arevalo in 1956.

(6) United Nations, Food and Agriculture Organization, "The Meat Problem in Latin America," *Economic Bulletin for Latin America*, Santiago, Chile, January, 1956, p. 63. See, also, *Anuario Estadistico, op. cit.*, 1955, Vol. I, pp. 146-147.

A GEOGRAPHICAL PROBLEM WITH A MATHEMATICAL SETTING

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TEACHERS of geography and mathematics may find it both interesting and instructive to present the problem which will be described below to their students. From the standpoint of geographic interest, the problem will bring out the precision or ambiguity with which such concepts as latitude and longitude are held; the clarity with which ideas governing conventional meanings of direction have been absorbed, when involving areas that are not plane surfaces; and the degree to which living north of the equator, as well as the familiar orientation of maps with the North Polar region toward the top, tend to create erroneous geographical judgment. From the standpoint of mathematical interest, the problem to be discussed brings out rather well the blockages to problem solving created by what the psychologist calls *rigidity of mental set*.

The problem, itself, arises out of one which psychologists are fond of using and which laymen treat as a standard brain-teaser. The problem takes many forms, but its most familiar setting is the following:

> A man is standing at a point, P, somewhere on the earth's surface. He then walks due South 10 miles, due East 10 miles, and due North 10 miles and finds himself back at point, P. Where is he?

The standard answer, of course, is the North Pole. Sometimes the word animal is substituted for man, the word it for he, and the word itself for himself, and the respondent is asked to identify the animal and/or name its color. In this case the correct answers are, of course, polar bear and white, respectively.

It is curious that, from a mathematical as well as a geographical standpoint, most intelligent respondents, including some sophisticated college professors, will insist that the North Polar point is the only point which correctly satisfies the conditions of the problem. This is frequently true even when the respondents are told specifically that there are loci containing an infinite set of points, each of which satisfies the mathematical and geographical constraints of the problem. They balk even more when they are told that, furthermore, there is an infinite set of such loci, each of which contains an infinite set of points satisfying the conditions of the problem. The discussion below is intended to show that this is so.

Consider a circle of latitude, A, in the neighborhood of the South Pole, which possesses a circumference of 10 miles. Now consider another circle of latitude, A′, which is 10 miles due North of A, and whose projection on the horizontal plane in which A lies would be concentric with A. Take any point, P_1', of A′ and apply the constraints of the problem already mentioned. If a subject were to walk 10 miles due South of P_1', he would land on some point,

P_1, on A. If he now moved 10 miles due East, he would circumnavigate the globe via the circle, A, and return to P_1. If he then walked due North 10 miles he would arrive back at P_1', of A'. This route satisfies the conditions of our problem. But P_1' is *any point* of circle, A'. Therefore, *every point* of A' satisfies the conditions of our problem, and A', of course, contains an infinite number of points.

In this connection, it is to be noted that walking due East is called for in a mathematical context only, in which it is assumed that the subject knows only the direction of the North Pole. If he then faces the North Polar point, due East would have to be the direction on his right, so that his route along A would have to be counterclockwise with reference to the North Pole, as he, himself, would describe it. This is because the earth rotates from West to East if one faces the fixed polar point and, since the direction of the rising sun, which is defined as being East, is a function of this rotation, East would then be on our subject's right and his route of travel would be given by a directed line running from his left to right.

A', however, is only one such locus which satisfies the conditions of our problem. Let us speak of A' and A as *geographically conjugate*. Two circles of latitude will be said to be geographically conjugate if they satisfy the conditions of our problem. It has been previously implied that there is an infinite set of such loci, each of which has its geographical conjugate. Let us designate B' as *any other member* of this set which, like A', has its geographical conjugate, B. What are the characteristics of B? B is a circle of latitude whose circumference is n, where the mathematical constraint, $10/n = Q$, holds; and where $n \leqq 10$ and such that Q will be an integer. Under these constraints, B too will satisfy the conditions of our problem. In this case the subject merely circumnavigates the globe Q times via B, traveling in a due East direction, and will always come back to a point, P_2, on B from which he had started to travel due East. Such a point, P_2, is conjugate to a point, P_2', on a circle of latitude, B', which is 10 miles due North of B, and whose projection on the horizontal plane in which B lies is concentric to B. Thus, for this situation, the subject has started from P_2', walked due South to P_2, and then circumnavigated B a total of Q times. After the Q-th circumnavigation, he finds himself at P_2 once more, walks due North 10 miles, and arrives at P_2', on B', which was his starting place. Therefore, this route satisfies the conditions of our problem. But B' is, by definition, *any other member* of an *infinite set* of loci, each of which possesses a geographical conjugate. It should be noted that, under these circumstances, there are an infinite number of *pairs* of circles of latitude which are geographically conjugate. For each such pair, the more northerly circle of latitude contains an infinite set of points which satisfy the conditions of the problem.

Thus far, it is clear that there are two classes of solution to our original problem. These are: (1) the *singular point* represented by the North Pole, and (2) any point in any one of the infinite set of loci, such as A'. Points in these two classes depend on a path defined by *motion of translation* for the subject. There is, however, one other class of solutions, namely, a locus containing an infinite set of points, each of which will satisfy the conditions of our problem but which depends upon using *motion of rotation* as an admissible means of movement by the subject. This latter class of solutions is given as follows. Take a circle of latitude, C', such that it is 10 miles due North of the South Polar point. Select any point, P_3', on C'. If a subject walks due South 10 miles, he will arrive at the South Pole. If he is now allowed to turn clockwise, using the South Polar point as a pivot, that is, from his left to his right, his rotation will match directionally the previous motions of translation. If we measure motion of rotation by the distance covered by a fixed, imaginary point, P_3, on, say, the subject's right arm, then this point will turn in a circle of circumference, c, in a plane parallel to existing circles of latitude. After m such rotations, where $mc = 10$ miles, the subject stops, walks due North 10 miles until he arrives again at P_3'. *(1)* This situation also satisfies the conditions of our original problem. Since, however, P_3' is *any point* of the locus, C', this demonstrates that there is a third class of solutions involving an infinite number of points.

It is appropriate at this time to generalize some of the foregoing observations. The first matter to be noted is that the standard

value for distance, d, namely 10 miles, is arbitrary. Whether or not we take cognizance of the fact that the earth is not a true sphere (by including or neglecting the actual flattening at the polar regions and the bulging at the equatorial regions), if we assume that the path of arc due South of the North Pole possesses any length, d, and the circumference of the circle of latitude to be circumnavigated from West to East is n, then the general conditions of our problem can be satisfied regardless of whether $d \gtreqless n$. If $d < n$, the path taken will be one of a class of spherical triangles, each possessing one vertex at the North Pole. If $d = n$, the path will be one which consists of a spherical arc from the North Polar point to a circle of latitude, followed by a single West to East circumnavigation of this circle, followed by a return route to the Pole along the original spherical arc. *(2)* If $d > n$, the path taken will be one of an infinite possible number, each of which consists of a spherical arc from the North Polar point to a circle of latitude, followed by the circumnavigation of this circle more than one complete time, followed by a return route to the Pole either along the original or a second spherical arc of length, d. *(3)* Thus, the North Polar point will satisfy the conditions of our problem whenever $O < d \leq C/2$, where C is the circumference of the earth, and motion of rotation is admissible.

For all of the preceding generalized conditions, the *singular solution* is the North Polar point. Generalized *non-singular solutions* to the problem are also possible, and these, unlike previous examples of non-singular solutions, do not have to involve conjugate loci both of which are either above or below the equator. Consider a circle of circumference, D′, somewhere between the North Pole and the equator. Let d be the distance of a path of arc, beginning at any point on D′ and ending somewhere below the equator. Then some circle of latitude, D, below the equator, such that the length of arc, d, is a multiple of the circumference, n, of the circle, D, will satisfy the conditions of our problem. Such a conjugate locus can always be found which will satisfy the constraints that $d/n = Q$, where Q is an integer. This can always be done by selecting a circle, D, below the equator, possessing circumference, n, then describing a longitudinal arc of length, Qn, which will pass above the equator, and drawing D′ so as to abut the terminus of this spherical arc.

We thus see that there are three separate domains in which geographical conjugates may be found: (1) between the North Pole and the equator, and including the latter, in which domain the North Polar point is, in effect, a singular conjugate of every other parallel on the earth's surface in this domain, being equivalent to a circle of latitude with zero radius; (2) between the equator and the South Polar point, and including both of these if motion of rotation is admissible at the South Pole; and (3) between the North and the South Poles, and including these if motion of rotation is admissible at the South Pole. These three separate domains, however, are only the artifacts of our analysis. If we forget these artifacts, we can legitimately claim that *any point on the earth's surface* is capable of satisfying the conditions of our problem, providing an appropriate specific value of d is selected.

Are there, then, classes of paired circles of latitude which *cannot* be geographical conjugates satisfying the conditions of our problem? The answer is clearly in the affirmative. Non-permissible paths will be found in each of our three artifactual domains. In each domain, a condition for a path to be non-permissible is clearly when the value of d, a path of arc between D′ and D, where D′ is the more northerly circle of latitude, is such that the governing constraint, $d/n = Q$, is not satisfied because $d < n$. Obviously, there is an infinite set of such geographical non-conjugates, D′ and D, where each D′ contains an infinite set of points which will not satisfy the conditions of our problem.

The upshot of all our preceding analysis, then, is this. Any given point on the earth's surface *may or may not* satisfy the conditions of our problem, depending upon the relation between d and n in the governing equation, $d/n = Q$. For all interpolar values of d where $d < C/2$, one half the circumference of the earth, where $n \leqq d$, and where Q is an integer, points can always be found to satisfy the given conditions. All values of d such that Q is not an integer, that is, $d < n$, and all values of n where $n < d$ but d/n does not yield an integral quotient, define non-permissible paths.

It may therefore be seen that the standard solution to our problem, namely, the North Polar point, is only one class of correct solutions involving a *singular point*, and that furthermore this solution is probably the least interesting one of all the several classes of possible solutions. These solutions are all proposed in a mathematical sense so that the practical requirements of effecting them geographically, involving astronomical considerations and navigational devices, are not at issue. The problem herein considered is elaborated upon because it is uncommon to find respondents who will notice any solution other than the singular, North Polar point, and because this inability, whether posed in a geographical or a mathematical context, illustrates so interestingly and strikingly what the psychologist calls *rigidity of mental set*.

* * *

(1) Note that if m is not an integer, the subject will return to C′ but not P_3', thus failing to achieve a solution.

(2) For this case to be true, one would have to establish the existence theorem that, somewhere south of the equator only, there is *at least one* circle of latitude, X, whose circumference is equal to the length of arc, d, from the North Pole to the circle, X. Once done, X is located by approximation methods only.

(3) For this case to be true for a return along the original arc, one would have to establish an existence theorem proving that there is *at least one* circle of latitude, Y, whose circumference, n, is such that the length of arc, d, is a multiple of n and that Y is somewhere below the equator.

DICHOTOMOUS KEYS TO THE KOPPEN SYSTEM*

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DESPITE criticism over several decades, the Koppen system is better known and more widely used than any other system of climatic classification. Most American textbooks in introductory climatology make at least passing reference to the system, and several authors use it as the basis for their exposition of climatic regions.

As a device for teaching elementary climatology, the system has obvious merits. By reducing numerous rainfall data to simply stated and easily compared formulae, it emphasizes the orderliness of the world's climatic pattern, and helps relate climates to gross patterns of natural vegetation. It can be argued also that students of introductory climatology should be familiar with the Koppen system, simply because Koppen's symbols constitute a kind of universal vocabulary which must be understood if one is to read the climatological literature intelligently.

Too often, however, a beginning student sees the system only as a series of disconnected formulae and arbitrary numbers. In trying to remember minute distinctions between symbols, he can too easily lose sight of the grand pattern of world climates — which it is the obvious purpose of the system to depict. In an introductory course, therefore, where time for detailed discussion is limited, use of the Koppen system as a teaching device can be self-defeating.

The main pedagogical objections to the system can be met by using a simple key, which enables students rapidly to assign proper Koppen symbols to any set of climatic statistics without having to memorize precise and often arbitrary definitions. The reason for using a key, rather than a simple list of definitions, is that several of Koppen's symbols are not mutually exclusive unless one is assigned clear precedence over another. For example, it is apparently possible for a climatic station to be classified either as *Da* or as *Dd*, if its hottest month is $> 71.6°$F., and its coldest month is $< -36.4°$F. In fact, Koppen *(1)* stipulates that *a* takes precedence over *d*, and therefore the station in question would be *a*, and not *d*. Likewise, the fact that *E* takes precedence over all other symbols is not evident from a statement of definitions alone. A key solves the problem of precedence by outlining the procedure for identification, as well as stating definitions of symbols.

The keys which are outlined below are modeled after analytic keys used by botanists for identifying plants. Such keys work by process of elimination, proposing a series of choices which lead step-by-step to

the proper classification. An important attribute of such keys is that each choice is dichotomous – that is, there are never more than two possibilities proposed at a time. If a key is not strictly dictotomous, the number of choices at any juncture is potentially infinite. The user of the key must stop at each juncture, therefore, to make sure that he has noted all possible choices, since he is never certain how many there may be. With only two choices available at a time, there is no question, and the user can proceed with certainty. Dichotomy, therefore, is essential if the key is to serve its purpose as a rapid and accurate device to identify unknowns.

Koppen himself includes a key to his system in the last major exposition of the classification. *(2)* This key, unfortunately, is not wholly dichotomous; multiple choices are proposed which would almost certainly confuse beginning students who are unfamiliar with the system. An adaptation of Koppen's key is included as an appendix to Kendall, Glendinning, and MacFadden's *Introduction to Geography (3)* and is an improvement over Koppen's original key because it is strictly dichotomous. The step-by-step process of elimination is broken into three parts, however, so that the student identifies individual letters, and not climatic types. The present keys are an attempt to improve Kendall's adaptation in two ways: first, they require only one unbroken operation to classify a given set of statistics; second, they use the outline form of standard botanical keys, which permits the student at a glance to see the whole range of available choices, and thus enables him readily to grasp the structure of the system.

These keys are based on Koppen's last exposition of his system (1936), but certain modifications should be noted. Special symbols, such as *g*, *n*, *i*, and *x*, are omitted because the keys are designed for beginning students; advanced students who use such refinements would scarcely need a key to classify climatic data. In addition, the *h/k* boundary within the *B* climates is defined by a mean temperature of 32° F. for the coldest month, rather than Koppen's mean annual temperature of 64.4° F.; likewise, the *C/D* boundary is 32° F. for the coldest month, instead of Koppen's 26.6°F. These boundary modifications, proposed by R.J. Russell *(4)* on the grounds that they reflect meaningful differences in American vegetation more accurately than do Koppen's, are incorporated in the present key because of their common application in American climatological literature. *(5)* One final amendment is necessary because Koppen fails to define quantitatively what is meant by a winter or summer rainfall regime in connection with the *B* climates. To correct the omission, Kendall's *(6)* definition of a winter rainfall concentration as $\geqq$ 70 per cent of mean annual rainfall concentrated in the coolest six months is adopted, with a comparable definition for a summer concentration.

The author has used a dichotomous key for three years for introducing students of beginning climatology to the Koppen system. During that time, certain unexpected advantages have come to light. Surprisingly, many students seem to enjoy the mechanical act of "keying out" a set of statistics. Evidently to demonstrate their newly acquired virtuosity, they often go to considerable lengths to find exotic statistics in hopes that they can confound the key and perhaps the laws of nature. Some students find that they have memorized the Koppen definitions with no apparent effort and have incorporated them into their working vocabularies. Thus, the Koppen system becomes what it was originally intended to be – not an academic nuisance, but a tool to speed the development of climatological understanding. The comprehensive key employed by the author follows:

A COMPREHENSIVE KEY*

(1) Warmest month< 50°: *E (POLAR)* . . . . . proceed to (2)

(2) Warmest month >32°: *ET (TUNDRA)*
(2) Warmest month <32°: *EF (GLACIAL)*

* Note: r = mean annual rainfall; t = mean annual temperature. All other temperature and rainfall statistics are mean monthly values. Rainfall is expressed in inches; temperature in degrees Fahrenheit.

(1) Warmest month >50°: *B*, *A*, *C*, or *D* (Non-polar) . . . proceed to (3)

(3) >70% of r concentrated in the warmest 6 months . . . . . proceed to (4)

(4) $r > 0.44t - 3$: *A*, *C*, or *D* (Humid non-polar) . . . . . proceed to (17)
(4) $r < 0.44t - 3$: *B (ARID)* . . . . . proceed to (5)

(5) $r > \frac{0.44t - 3}{2}$: *BS (STEPPE)* . . . . . proceed to (6)

(6) Coldest month > 32° : ***BSh (TROPICAL or SUBTROPICAL STEPPE)***
(6) Coldest month < 32° : ***BSk (MID-LATITUDE STEPPE)***

(5) $r < \frac{0.44t - 3}{2}$: *BW (DESERT)* . . . . . proceed to (7)

(7) Coldest month > 32° : ***BWh (TROPICAL or SUBTROPICAL DESERT)***
(7) Coldest month < 32° : ***BWk (MID-LATITUDE DESERT)***

(3) < 70% of r concentrated in the warmest 6 months . . . . . proceed to (8)

(8) > 70% of r concentrated in the coolest 6 months . . . . . proceed to (9)

(9) $r > 0.44t - 14$: *A*, *C*, or *D* (Humid non-polar) . . . . . proceed to (17)
(9) $r < 0.44t - 14$: *B (ARID)* . . . . . proceed to (10)

(10) $r > \frac{0.44t - 14}{2}$: *BS (STEPPE)* . . . . . proceed to (11)

(11) Coldest month > 32° : ***BSh (TROPICAL or SUB-TROPICAL STEPPE)***
(11) Coldest month < 32° : ***BSk (MID-LATITUDE STEPPE)***

(10) $r < \frac{0.44t - 14}{2}$: *BW (DESERT)* . . . . . proceed to (12)

(12) Coldest month > 32°: ***BWh (TROPICAL or SUB-TROPICAL DESERT)***
(12) Coldest month < 32° : ***BWk (MID-LATITUDE DESERT)***

(8) < 70% of r concentrated in the coolest 6 months . . . . . proceed to (13)

(13) $r > 0.44t - 8.5$: *A*, *C*, or *D* (Humid non-polar) . . . . . proceed to (17)
(13) $r < 0.44t - 8.5$: *B (ARID)* . . . . . proceed to (14)

(14) $r > \frac{0.44t - 8.5}{2}$: *BS (STEPPE)* . . . . . proceed to (15)

(15) Coldest month > 32° : ***BSh (TROPICAL or SUB-TROPICAL STEPPE)***
(15) Coldest month < 32° : ***BSk (MID-LATITUDE STEPPE)***

(14) $r < \frac{0.44t - 8.5}{2}$: *BW (DESERT)* . . . . . proceed to (16)

(16) Coldest month > 32° : ***BWh (TROPICAL or SUB-TROPICAL DESERT)***
(16) Coldest month < 32° : ***BWk (MID-LATITUDE DESERT)***

(17) Coldest month > 64.4° : *A (HUMID TROPICAL)* . . . . . proceed to (18)

(18) Driest month with > 2.4″ rain: *Af (TROPICAL RAIN FOREST)*
(18) Driest month with < 2.4″ rain: *(TROPICAL WET-AND-DRY)* . . . . . proceed to (19)

(19) Rain of driest month > (3.94 − r/25)″; *and*, if certain months have no rain, r > (number of rainless months) X (98.5)″ : *Am (TROPICAL MONSOON)*
(19) Rain of driest month < (3.94 − r/25)″; *or*, if certain months have no rain, r < (number of rainless months) X (98.5)″ . . . proceed to (20)

(20) Dry season during period of low sun: *Aw (TROPICAL SAVANNA)*
(20) Dry season during period of high sun: *As (TROPICAL SAVANNA WITH WINTER RAIN)*

(17) Coldest month < 64.4° : *C* or *D* (Humid mid-latitude) . . . . . proceed to (21)

(21) Coldest month > 32° : *C (HUMID MESOTHERMAL)* . . . . . proceed to (22)

(22) Driest winter month with < 1/10 rain of wettest summer month : *Cw (HUMID MESOTHERMAL WITH WINTER DROUGHT)* . . . . proceed to (23)

(23) Warmest month > 71.6° : *Cwa (SUBTROPICAL MONSOON)*
(23) Warmest month < 71.6° : *Cwb (TROPICAL UPLAND)*

(22) Driest winter month with > 1/10 rain of wettest summer month : *Cf* or *Cs* . . . . proceed to (24)

(24) Driest summer month with < 1.6″ of rain, *and also* with < 1/3 rain of wettest winter month: *Cs (MEDITERRANEAN)* . . . . proceed to (25)

(25) Warmest month > 71.6° : *Csa (MEDITERRANEAN, INTERIOR TYPE)*
(25) Warmest month < 71.6° : *Csb (MEDITERRANEAN, COASTAL TYPE)*

(24) Driest summer month with > 1.6″ of rain, *or* with > 1/3 rain of wettest winter month : *Cf (HUMID MESOTHERMAL WITH NO DRY SEASON)* . . . . . proceed to (26)

(26) Warmest month > 71.6° : *Cfa (HUMID SUBTROPICAL)*
(26) Warmest month < 71.6° . . . . . proceed to (27)

(27) 4 or more months > 50° : *Cfb (MARINE WEST COAST)*
(27) 1 to 3 months > 50° : *Cfc (HIGH LATITUDE MARINE)*

(21) Coldest month < 32° : *D (HUMID CONTINENTAL)* . . . proceed to (28)

(28) Driest winter month with < 1/10 rain of wettest summer month: *Dw (HUMID CONTINENTAL WITH WINTER DROUGHT)* . . . . . proceed to (29)

(29) Warmest month > 71.6° : *Dwa (HUMID CONTINENTAL WITH WINTER DROUGHT AND LONG HOT SUMMERS)*
(29) Warmest month < 71.6° . . . . . proceed to (30)

(30) 4 or more months > 50° : *Dwb (HUMID CONTINENTAL* WITH WINTER DROUGHT AND LONG WARM SUMMERS)
(30) 1 to 3 months > 50° . . . . proceed to (31)

(31) Coldest month > −36.4° : *Dwc (SUBARCTIC WITH WINTER DROUGHT)*

(31) Coldest month $< -36.4°$: *Dwd (SUBARCTIC WITH WINTER DROUGHT AND BITTERLY COLD WINTERS)*

(28) Driest winter month with $> 1/10$ rain of wettest summer month: *Ds* or *Df* . . . . proceed to (32)

(32) Driest summer month with $< 1.6''$ rain, *and also* with $< 1/3$ rain of wettest winter month: *Ds (HUMID CONTINENTAL WITH SUMMER DROUGHT)* . . . . . proceed to (33)

(33) Warmest month $> 71.6°$: *Dsa (HUMID CONTINENTAL WITH SUMMER DROUGHT AND LONG HOT SUMMERS)*

(33) Warmest month $< 71.6°$: *Dsb (HUMID CONTINENTAL WITH SUMMER DROUGHT AND LONG WARM SUMMERS)*

(32) Driest summer month with $> 1.6''$ rain, *or* with $> 1/3$ rain of wettest winter month: *Df (HUMID CONTINENTAL WITH NO DRY SEASON)* . . . . . proceed to (34)

(34) Warmest month $> 71.6°$: *Dfa (HUMID CONTINENTAL WITH NO DRY SEASON AND LONG HOT SUMMERS)*

(34) Warmest month $< 71.6°$ . . . proceed to (35)

(35) 4 or more months $> 50°$: *Dfb (HUMID CONTINENTAL WITH NO DRY SEASON AND LONG WARM SUMMERS)*

(35) 1 to 3 months $> 50°$ . . . proceed to (36)

(36) Coldest month $> -36.4°$: *Dfc (SUBARCTIC WITH NO DRY SEASON)*

(36) Coldest month $< -36.4°$: *Dfd (SUBARCTIC WITH NO DRY SEASON AND BITTERLY COLD WINTERS)*

It is obvious that the above key can be modified in any number of ways. For example, in an introductory course, where the discussion of climatic classification must be brief, the key may be too detailed. The abbreviated key below is an example of such a modification. It omits reference to the unusual *As* and *Ds* climates, makes no distinction between *Df* and *Dw*, and refers the student to tables, instead of specifying formulae, to define the *B/Humid*, the *BS/BW*, and the *Am/Aw* boundaries. (Appropriate tables are published in Kendall, Glendinning, and MacFadden, *Introduction to Geography*, 2nd ed., pp. 608-611.) In addition, a brief descriptive phrase is inserted at the outset of each dichotomy, phrased in qualitative terms so that the student can grasp at a glance the essential difference between alternatives. The author has found that inclusion of these qualitative descriptions makes it much easier for students to use the key.

AN ABBREVIATED KEY

(1) Cold all year; warmest month $< 50°$: *E (POLAR)* . . . . . proceed to (2)

(2) Perpetually frozen; warmest month $< 32°$: *EF (GLACIAL)*

(2) Summer thaw; warmest month $> 32°$: *ET (TUNDRA)*

(1) Warm at least part of the year; warmest month $> 50°$: *B*, *A*, *C*, or *D* (Non-polar) . . . . . proceed to (3)

(3) Dry; rainfall $<$ potential evaporation (see table): *B (ARID)* . . . . . proceed to (4)

(4) Extremely dry; rainfall $<$ ½ potential evaporation: *BW (DESERT)* . . . . . proceed to (5)

(5) Cold winter; coldest month $<$ 32° : *BWk (MID-LATITUDE DESERT)*
(5) Mild winter; coldest month $>$ 32° : *BWh (SUBTROPICAL or TROPICAL DESERT)*

(4) Moderately dry; rainfall $>$ ½ potential evaporation : *BS (STEPPE)* . . . . . proceed to (6)

(6) Cold winter; coldest month $<$ 32° : *BSk (MID-LATITUDE STEPPE)*
(6) Mild winter; coldest month $>$ 32° : *BSh (SUBTROPICAL or TROPICAL STEPPE)*

(3) Humid; rainfall $>$ evaporation: *A*, *C*, or *D* (Humid non-polar) . . . . . proceed to (7)

(7) Warm all year; coldest month $>$ 64.4° : *A (TROPICAL)* . . . . . proceed to (8)

(8) Humid all year; driest month $>$ 2.4" rain: *Af (TROPICAL RAIN FOREST)*
(8) Marked dry season; driest month $<$2.4" rain: *(TROPICAL WET-AND-DRY)* . . . . . proceed to (9)

(9) Dry season not droughty; lack of rain in dry season compensated by excess rain in rainy season (see table): *Am (TROPICAL MONSOON)*
(9) Dry season droughty; rain in rainy season insufficient to compensate for drought in dry season: *Aw (TROPICAL SAVANNA)*

(7) Not warm all year; coldest month $<$ 64.4° : *C* or *D* (Humid mid-latitude) . . . . . proceed to (10)

(10) Mild winter; coldest month $>$ 32° : *C (HUMID MESOTHERMAL)* . . . . . proceed to (11)

(NOTE: The key for the *C* climates is omitted here because it would be the same as in the expanded key above, except for the need for inserting introductory descriptive phrases. Since the *C* key includes 6 dichotomies, which would be numbered 11 through 16, the *D* key proceeds from choice 10 to choice 17.)

(10) Cold winter; coldest month $<$ 32° : *D (HUMID CONTINENTAL)* . . . . . proceed to (17)

(17) Hot summer; warmest month $>$ 71.6° : *Da (HUMID CONTINENTAL WITH HOT SUMMERS)*
(17) Warm summer; warmest month $<$ 71.6° . . . . . proceed to (18)

(18) Long summer; 4 or more months $>$ 50° : *Db (HUMID CONTINENTAL WITH LONG WARM SUMMERS)*
(18) Short summer; 1 to 3 months $>$ 50° . . . . . proceed to (19)

(19) Cold winter, but not bitterly so; coldest month $>$ −36.4°: *Dc (SUBARCTIC or TAIGA)*
(19) Bitterly cold winter; coldest month $<$ −36.4° : *Dd (SUBARCTIC WITH BITTERLY COLD WINTERS)*

* * *

(*) Contribution No. 61-1 from the College of Mineral Industries, The Pennsylvania State University.

(1) Koppen, W. and Geiger, R., *Handbuch der Klimatologie*, Band I, Teil C, Gebruder Borntraeger, Berlin, 1936, p. C43.

(2) *Ibid.*, pp. C5-C44.
(3) Harcourt, Brace, 2nd Edition, New York, 1958, pp. 613-614.
(4) Russell, R.J., "Climates of California," *Univ. Calif. Publications in Geography*, Vol. 2, 1926, pp. 76-77; "Dry Climates of the United States," *Univ. Calif. Publications in Geography*, Vol. 5, 1931, pp. 27-38; "Climatic Years," *Geographical Review*, Vol. 24, 1934, p. 97.
(5) See, e.g., Ackerman, E.A., "The Koppen Classification of Climates in North America," *Geographical Review*, Vol. 31, 1941, pp. 108-109. Also, Trewartha, G.T., *An Introduction to Climate*, 3rd Edition, McGraw-Hill, New York, 1954, pp. 233, 235.
(6) Kendall, H.M., "Notes on Climatic Boundaries in Eastern United States," *Geographical Review*, Vol. 25, 1935, pp. 117, 120.

A RAILROAD TO GREAT SLAVE LAKE*

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THE CONSTRUCTION of a railroad to Great Slave Lake, in the Northwest Territories of Canada, has been proposed for over six years. The Dominion and local governments, mining companies, and most individuals are in favor of it. Consolidated Mining and Smelting Company of Canada, Limited (Cominco), which controls valuable lead-zinc property at Pine Point (Fig. 1), is especially interested. Nevertheless, no agreement has been reached as to what route such a railroad should take, and therefore construction has not been started.

The current transportation situation. At present, no railroad penetrates the Northwest Territories from southern Canada. The only surface transportation connection between the Northwest Territories and the rest of Canada is the Mackenzie Highway, which extends from Grimshaw, Alberta, to Hay River on the southern shore of Great Slave Lake (Fig. 1). This was a winter road until 1949, when it was converted into an all-season route.

A northward extension, the Great Slave Highway, was completed in 1960. It links the Mackenzie Highway with Yellowknife, on the north side of Great Slave Lake, via the northwestern shore of the lake. However, the presence of a ferry instead of a bridge across the Mackenzie River at Fort Providence (Fig. 1) limits the over-all use of this route to three summer months and five winter months. In autumn, ferry traffic is halted by freeze-up, and six to eight weeks pass before the ice becomes solid enough to permit crossings. Traffic again ceases in the early spring with the gradual weakening of the ice, and another hiatus results until the ice breaks up and ferry service can be resumed. It is, therefore, not entirely correct to call the Great Slave Highway an all-season route.

The location, pioneer nature, and physical setting of the Great Slave Lake district is responsible for high transportation costs. First of all, the region is remote from major producing and consuming centers of North America, and distance typically increases transportation costs. Second, because of the frontier character of the region, population is sparse and long distances exist between settlements. The resultant low traffic density makes transportation expensive. Third, the physical setting discourages construction of surface transportation facilities. Building and maintenance costs are almost prohibitive for both highways and railways because of the presence of lakes, muskeg, and permafrost, especially on the Canadian Shield.

Movement of freight by water is possible only three months of the year due to the northerly climate. Thus, the initial economy of low barge freight rates is offset by warehousing costs resulting from storing almost a whole year's inventory. Also, considerable rehandling is necessary, from railroad to barge at Waterways, and from barge to truck to barge at the Bell Rock Portage on the Slave River between Fort Fitzgerald and Fort Smith (Fig. 1). Rehandling is expensive, time-consuming, and damaging. Water carrier rates in Canada as a whole average between 2 and 5 cents per ton-mile, whereas those of the north-

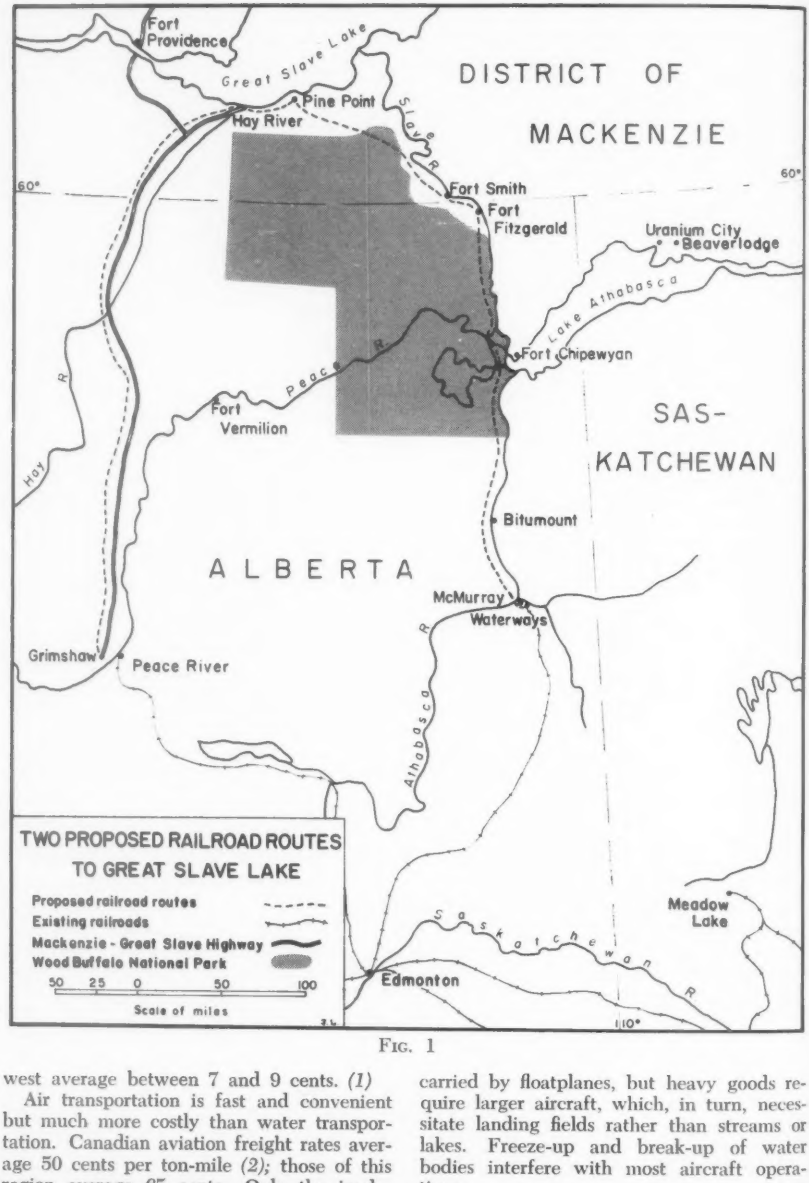

FIG. 1

west average between 7 and 9 cents. *(1)*

Air transportation is fast and convenient but much more costly than water transportation. Canadian aviation freight rates average 50 cents per ton-mile *(2)*; those of this region average 65 cents. Only the inadequacy of all other forms of transportation spurs use of aircraft. Light cargo can be carried by floatplanes, but heavy goods require larger aircraft, which, in turn, necessitate landing fields rather than streams or lakes. Freeze-up and break-up of water bodies interfere with most aircraft operations.

For a host of geographic and geologic reasons, the economy of the Northwest Ter-

ritories, especially eastern Mackenzie, is based largely upon mineral extraction. At present, local mineral industries rely upon water-borne carriers in summer, tractor-trains in winter, and aircraft at all times possible. Gold and uranium are the only metals which are mined. Their very high unit values, averaging $33 per ounce of gold and $10 per pound of U_3O_8, compensate for high costs of long hauls to market. Base metals, with their comparatively low unit values, cannot be shipped out by air as are gold and uranium.

Need for a railroad. A railhead on Great Slave Lake would benefit existing mines as well as permit development of promising base metal prospects. The Pine Point deposit, located near the south shore of the lake, is said to contain the largest ore reserves of lead and zinc in North America, 60,000,000 tons. *(3)* Cominco has delayed further development of this property until such time as a railroad is built to the lake. When Cominco and the administration of the Northwest Territories investigated comparative advantages of a railroad versus an extension and improvement of the Mackenzie Highway, their conclusion was that, for a volume in excess of 75,000 to 100,000 tons per year, the railroad would be more economical. Cominco expects to freight in and out approximately 200,000 to 250,000 tons annually in the early stages, and more later. *(4)* Cominco would, of course, benefit from such a railroad; and it is worth noting that the Canadian Pacific Railways holds a controlling interest of stock in Cominco. Presumbaly, however, the rest of Canada would benefit too; a conservative estimate by the Gordon Commission (the Royal Commission on Canada's Economic Prospects) suggests that $25 million would be contributed to the Gross National Product by Pine Point's ore production and by secondary industries connected with mining. *(5)*

In addition to the Pine Point deposit, there are many less spectacular, yet substantial, metal prospects in the vicinity of Great Slave Lake. Among islands north and east of Pine Point are the Outpost Islands, with tungsten, gold, silver, and copper prospects; the Easter Islands, with nickel, cobalt, and silver prospects; and the Simpson Islands, with nickel, copper, and silver prospects. Across the lake, and north of McLeod Bay, is the Indian Mountain Lake district where exploration indicates substantial lead and zinc deposits. West of there, in the Beaulieu district, lithium, columbium, tantalum, molybdenum, beryllium, and gold prospects are staked. Sulphur Bay, located at the western edge of Great Slave Lake, about 60 miles east of Fort Providence, has lead and zinc prospects occurring within the same limestone formation as at Pine Point. All these deposits are lying dormant at present, awaiting improved transportation facilities which will permit their exploitation.

The Canadian government sets forth the following reasons for building a railroad to Great Slave Lake. First of all, it would lower freight rates. Studies made by the administration of the Northwest Territories indicate that general merchandise rates between Yellowknife and Edmonton would be reduced by 25 to 30 per cent from existing rates. *(6)* The reduction in freight rates to Norman Wells or Aklavik, much farther to the northwest, would be less than that, but still substantial. Second, a railhead on Great Slave Lake would permit all-year freight movement to the lake instead of merely to Waterways (Fig. 1); and rail freight rates to the lake would be 40 per cent less than truck freight rates via the Mackenzie Highway. *(7)* Moreover, with the head of navigation situated 500 miles farther down the Mackenzie River system than it is now, existing vessels could carry more freight than at present between the railhead and Yellowknife, as well as to the mouth of the Mackenzie River, during the brief shipping season. Third, a rail line would increase the traffic-handling capacity of the existing Waterways – Great Slave Lake river route. At present, there is often congestion at the Bell Rock Portage, between Fort Smith and Fort Fitzgerald; and a bottleneck exists at the mouth of the Athabasca River, near Fort Chipewyan. The present river system could not handle greatly increased loads, such as might develop through production from the Pine Point and other new mines.

Controversy over the railroad route. Although the need for, and advantages of, a railway are agreed upon, a heated sectional controversy over the proposed route has delayed its construction for over half a decade. At first, four or five routes were proposed. British Columbia wanted the line to start at Fort St. John, on the upper

Peace River, in order to connect its Pacific Great Eastern Railway with Great Slave Lake. It also favored a line north from Grimshaw (Fig. 1), because the Pacific Great Eastern Railway meets the Northern Alberta Railways there. Alberta was interested in a line north from Grimshaw, or else one from Waterways (Fig. 1). Saskatchewan proposed a rail route that would go through Uranium City (Fig. 1) on its way to Great Slave Lake. The proposals of the competing provinces have since been reduced to two: the western route from Grimshaw, and the eastern route from Waterways.

The 437-mile western route would cost in the neighborhood of $65 million. *(8)* It would parallel the Mackenzie Highway, all the way from Grimshaw to Hay River (Fig. 1), where a spur would connect it with Pine Point. The railway would pass through the Peace River district, an area rich in timber and agricultural potential. Its proponents say it would help the so-called little man rather than large urban industrial interests, and claim that farming and forestry are more stable than mining, so that an investment in transportation would be of longer lasting value. Opponents point out that production from thousands of acres of new wheatland in the Peace River district would add to the wheat glut, which is already one of Canada's biggest farm problems.

The route from Waterways would be 418 miles long and would cost roughly $75 million. The comparatively greater construction cost would be due to rougher topography, and more muskeg and permafrost areas. This line would parallel the present barge route, but would emerge onto the lake near Pine Point. Backers of this route point to the promising mineral, petroleum, and hydroelectric potentials to be found along its right of way. These include gypsum deposits, the McMurray tar sands near Bitumount (Fig. 1), and a potential hydroelectric generating capacity of 300,000 horsepower from the rapids of the Slave River south of Fort Smith. The timber resources of Wood Buffalo National Park (Fig. 1) and the Slave River valley are also noted. The eastern route would simplify movement of heavy goods to Lake Athabasca, Fort Smith, and Great Slave Lake, and would avoid navigation hazards in the rivers. The Canadian Pacific and Canadian National Railways consider the Waterways route more economical. They have offered to build it with a $20 million government subsidy. If the Grimshaw route is chosen, the government will have to pay its entire cost.

The Dominion government decided in 1959 to choose the eastern route, but the decision caused such a furor in the Peace River district and in British Columbia that a Royal Commission was appointed to decide the question. The three members could not agree upon a selection; one chose the eastern route, one the western, and, indeed, one wondered if the railroad was really necessary! This lack of agreement forced a further delay in surveying and construction. The matter has now been placed in the hands of the Dominion Cabinet.

In the meantime, Cominco has become impatient with the delay. Previously, low market prices for lead and zinc, plus Cominco's own large ore reserves in British Columbia, kept the company satisfied. It did not then need ore from Pine Point. Now, however, zinc reserves are running low. If zinc cannot be mined and brought out from Pine Point by 1964, Cominco will have to import it from Peru. If a railroad is not started in 1961, it probably will not be finished by 1964, in which case Cominco would have to import zinc concentrate or build a highway connection between Pine Point and the Mackenzie Highway. Neither of these possibilities would be as economical as a railroad; hence the impatience.

Conclusion. The Dominion Cabinet has been silent so far, although it is generally conceded, as of July, 1961, that the western route will be chosen. A bill presumably will be presented to Parliament within 1961. Once construction starts, the railway will be most influential in determining which of many mineral prospects will become productive ore bodies.

* * *

(*) This article is a slightly revised version of a paper presented at the AAG meetings in East Lansing, Michigan, during August of 1961.

(1) *Preliminary Report, Royal Commission on Canada's Economic Prospects*, Ottawa, 1956, p. 276.

(2) *Ibid.*, p. 277.

(3) Robertson, R.G., Commissioner of the

Northwest Territories, *The Northwest Territories, Its Economic Prospects: A Brief Presented to the Royal Commission on Canada's Economic Prospects*, Ottawa, 1955, p. 8.
(4) *Ibid.*, p. 27.
(5) *Ibid.*
(6) *Ibid.*, p. 24.
(7) *Ibid.*, p. 25.
(8) *Financial Post*, Toronto, Sept. 10, 1960, p. 46.
(9) *Ibid.*

CAICOS, CONFUSION, CONCLUSION

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AN ATTEMPT to pinpoint the first Columbian landfall in America is no bit of historico-geographical triviality that should be belittled by real or imagined academicians. The writer had rather hoped that his earlier article concerning Columbus (1) would stir some of the better cartographers and historical geographers to seize upon the Columbus log and come up with their own reconstructions of the First Voyage. He took for granted that they would employ the scientific method. It is a little disappointing to see a scholar of Doran's potential search so meticulously through the author's brief paper for errors. (2) The Columbus log is far more challenging, and Morison's works offer immensely more in the way of mistakes. But it is flattering to be numbered among the curiously tenacious, and the only regret is that there are so few who are! If Doran is not already too committed to the faltering status quo, he will be welcomed as a convert who will assist in the solution of a most intriguing problem. But let us have no more revisions of the log and invention of hallucinations.

If the writer, in his previous paper, committed only six errors, as Doran claims (3), then he is content to rest his case before the jury of American geographic opinion. For, if Doran accepts all other premises and the conclusions they force, the great bulk of evidence remaining confirms the original hypothesis that Caicos Island is *San Salvador*.

Let us examine each so-called error cited by Doran and attributed to the author. (4) The reader should have the two pertinent articles and a reasonably good map of the area in front of him. If the sketch map (Fig. 1) in the original article is used, note that Long Island is placed 30′ too far to the north. It is unfortunate that Doran did not contribute a map to the fund for use in comparing the two theories. In addition, it will aid one to follow the discussion more completely if a copy of the Columbus log is also at hand. (5)

So-called Error No. 1: Since both the east and west coasts of a narrow, elongated island are aligned generally in the same direction, there is little to cause an issue here. But, to clear the record, the eastern side of Acklin (Island III on the sketch map) trends about the same as the western side, northeast-southwest. At the cape where Columbus landed (". . . y este cabo adonde yo vine. . . .") (6), the coast does indeed run north-northwest – south-southeast; in fact, there are a number of places on the eastern side of Acklin where the coast trends in that direction. But the island, over-all, trends northeast-southwest. Columbus had to *round* the island in a storm to reach the southern end. (7) An analogy would be where the Mississippi River flows north in New Orleans, but no one really makes a case for such an orientation for the entire river!

So-called Error No. 2: *Cabo Verde* is at the southern end of Acklin (Island III). The writer placed it at the southwestern end of the island, since Acklin trends northeast-southwest. However, he is willing to put this cape at the extreme southeastern tip of this southwestern end. In either case, *Cabo Verde* is southwest of the point of landfall in the east-central portion of this island. But how is Doran going to explain Morison's placing of *Cabo Verde* on the southwestern tip of the southern end of Long Island (Watlingites' III)? (8)

So-called Error No. 3: There is nothing to debate here. Columbus said easterly. Neither the writer's theory nor Morison's permits a due easterly course. However, the ships departed Island III on three dif-

ferent courses: the *Pinta* proceeded east-southeast, the *Santa Maria* southeast, and the *Nina* south-southeast. *(9)* They later rendezvoused and sailed "east" to Island IV.

So-called Error No. 4: No one can say with certainty what the *Santa Maria's* top speed would have been for a measured mile under perfect or any other conditions. But Doran commits a serious error himself when he says the "maximum speed must have been less than 10 knots." *(10)* Columbus writes that he exceeded this speed on a number of occasions and reached 15 miles per hour at least once. *(11)* Seventy-five miles, more or less, could easily be covered in the specified six hours at less than the reported top speed. The question of height of eyesight becomes significant at this point. This height was no less than 30 feet for a man on the poopdeck of the *Santa Maria*, and 70 to 75 feet from the crow's nest. At this height, an unforested, low-lying island can be seen from about 12 miles on a clear day. A 100-foot-high hill is visible at a distance of about 17 miles; a 200-foot-high hill at more than 20 miles. Heavily forested, with tall trees, moderate hills are discernible at 35 miles. And, of Great Inagua (Island IV), Columbus writes, ". . . mas alta que las otras islas falladas . . . y ha muchos arboledos, y muy espesos y muy grandes." *(12)*

So-called Error No. 5: Columbus did state that he sailed west-southwest from Island IV. However, if he had, he would have been retracing his route of October 19-20. He was obviously going away (westward) from the island. At sundown on October 24, he stated that *Cabo Verde* (southern tip of Island III) lay 28 miles to the northwest. If *Cabo Verde* is at the southern tip of Long Island (Watlingites' Island III), then the Admiral was still north of Crooked Island. How could he be situated thusly if he had sailed west-southwest for 18 hours with a good breeze? The apparent confusion here has a simple explanation. To reach Cuba, where he was heading after being told of its wealth by his Indian guides, he would have had to sail west-southwest from Island IV. It is clear that he followed, instead, the traditional canoe route via the *Islas del Arena*. Even Morison admits that Columbus did not follow the coast of Island IV to *Cabo Hermoso*, which a west-southwest course would have dictated.

So-called Error No. 6: Columbus at first placed the *isleo* off the northern coast of Island IV. Later he coasted this island by going west-southwest and returning north-northeast to *Cabo del Isleo*. This route forces the conclusion that the *isleo* is off the northeast coast, but would also be off the northern coast at one and the same time. Watlingites want to use Bird Rock as their *isleo*. For one thing, it is northwest of their Island IV (Crooked). Furthermore, it is doubtful that Columbus would have called Bird Rock an *isleo*, a term he reserved for medium-sized islands.

Enough of the so-called errors that are presumed to make the writer's position untenable. If anything, their full explanation adds strength to the original statement. For those, including Doran and other Watlingites, who wish to *honestly* end this public debate, a search of the Bahamas for the following facts is suggested.

Island I: about 60 miles long and shaped like a bean-pod; about 32 miles eastward of Island IV; about 28 miles eastward of Island II; about 20 to 30 miles southwest of a point where a light was seen on October 11; a location to the east for that light; heavily forested; flat; a lagoon large enough for "all the ships of Christendom," surrounded by a reef with a narrow passage; a peninsula suitable for a fort near the harbor entrance; water in the lagoon as "calm as a well"; over 100 islands visible from *San Salvador*.

This is a good description of the Caicos group. Lorimer Creek, in the north, seems to be the harbor passage and the site for a fort is still scarred from fortifications erected by sugar planters some years ago. Watling (Morison's Island I) is only 12 miles long and six miles wide. It is not long, narrow, and curved like an *haba*. There is no harbor capable of handling thousands of ships. Only one island, Rum Cay, can be seen from Watling. There is no island east of Watling where a light could be seen. And, even Morison admits that Watling is unapproachable from the east. *(13)* Morison would have one believe that Columbus neglected to record the fact that he landed on Watling's *west* coast!

Island II: westward of Island I about 28 miles; 32 to 36 miles east of Island III; east coast about 20 miles long; north coast about 40 miles long; cape at northwestern

corner; flat; wooded; good beach, but offshore rocks.

Mayaguana is correctly located and described, except that it is only 30 miles long from east to west and eight miles wide. Admittedly, this is a weak link in the chain constructed by the author. But the island Doran supports is only 11 by six miles! His link seems to be the weaker.

Island III: 32 to 36 miles due west of Island II; between 80 and 112 miles long, over-all; harbor large enough for 100 ships; entrance to harbor appears to be a river mouth blocked by an island; harbor entrance is eight miles west of the northeastern corner of the island; there is a southern cape *(Cabo Verde);* 28 miles southeast of *Cabo Verde* is a position 60 miles west of the *isleo* on the northeastern corner of Island IV; this same position is 48 miles from *Cabo Hermoso* to the southeast; at spot where Columbus landed, the coast trends north-northwest–south-southeast.

This description fits Acklin-Crooked so well that no further comment is necessary. Long Island, Watlingites' Island III, is only 17 miles from their Island II (Rum Cay). There is no 100-ship harbor or *isleo.* The cape at the southern tip of Long Island is on the southwestern tip, and, as Doran points out, the cape must be on the southeastern tip, as at Acklin.

Island IV: about 75 miles southeast of Island III, and 32 miles westward of Island I; it is 48 miles between the northeastern cape *(Cabo del Isleo)* and the western cape *(Cabo Hermoso); isleo* off northeastern corner of island; reefs north of *isleo,* and between it and main island; from *Cabo del Isleo,* the coast trends west-southwest to *Cabo Hermoso;* coast makes sharp angle at *Cabo Hermoso;* southwestern cape *(Cabo de la Laguna)* with large lagoons behind it; rocks off south coast.

A reliable description of Great Inagua, but a poor one for Island IV of Morison. Islands I and IV should be 32 miles apart, but Watlingite choices are 70 miles from each other. Bird Rock, the *isleo* Doran prefers, has been discussed.

Lastly, and inasmuch as everyone agrees on the Cuban ports visited, locate a point 28 miles northeast of Puerto Tanamo, Cuba (note: Fig. 1 in the author's original article erroneously shows 24 miles), and then a point 72 miles northeast by east from that. At that point, some 100 miles northeast of Cuba, Columbus was 48 miles from *Cabo Hermoso* (Island IV). This same point should be 28 miles southeast of Island III, and 60 miles westward from the *isleo* northeast of Island IV. This is the writer's Rosetta Stone. He is confident there is none for the discredited Watling theory. May we now get on with the serious business of moving that discovery monument to Caicos, the *San Salvador* of Columbus?

* * *

(1) Fuson, Robert H., "Caicos: Site of Columbus' Landfall," *The Professional Geographer,* Vol. XIII, No. 2, March, 1961, pp. 6-9.

(2) Doran, Edwin, Jr., "This Columbus-Caicos Confusion," *The Professional Geographer,* Vol. XIII, No. 4, July, 1961, pp. 32-34.

(3) *Ibid.,* p. 33.

(4) *Ibid.*

(5) Navarrete, Martin Fernandez de, *Viajes de Cristobal Colon,* Madrid, 1934.

(6) *Ibid.,* p. 35.

(7) *Ibid.,* p. 39.

(8) Morison, Samuel E., *Christopher Columbus, Mariner,* New York, 1942, p. 45.

(9) Navarrete, *op. cit.,* p. 40.

(10) Doran, *op. cit.,* p. 33.

(11) Navarrete, *op. cit.,* p. 22.

(12) *Ibid.,* pp. 40-41.

(13) Morison, *op. cit.,* p. 42.

THE FIRST USE OF THE DOT TECHNIQUE IN CARTOGRAPHY*

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AT THE 1952 meeting of the International Geographical Union, held in Washington, D.C., Helmer Smeds stated that as far as he knew "the dot method was used for the first time in the history of cartography" in 1898 by A.O. Kihlman, the then President of the Geographical Society of Finland. *(1)* This was on a map showing the distribution of population in a limited area of Finland's west coast.

However, a map which also uses the dot technique to show population distribution

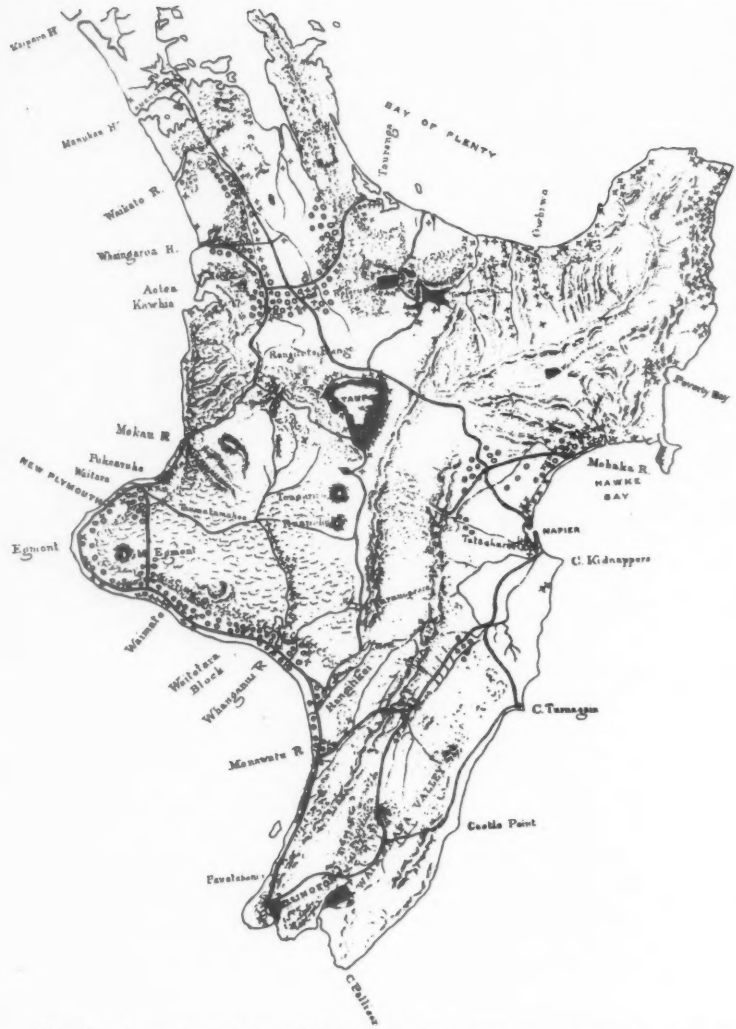

FIG. 1. A portion of the 1863 New Zealand map on which each cross represents 100 Maoris. The circles represent proposed military settlements. Photograph courtesy of the Alexander Turnbull Library, Wellington.

was published in New Zealand 35 years prior to the Finnish one. On an untitled map (Fig. 1) included in "Memorandum on Roads and Military Settlements in the Northern Island of New Zealand," published in the *Appendix to Journals, House of Representatives*, 1863 (A-8a), the distribution of native Maoris is shown by crosses, with "approximately each cross representing about 100 souls." Unfortunately, the author of the map is not identified.

The map is 14.9 inches high by 11 inches

wide. No scale is indicated, but it is approximately 1 inch to 27 miles. Besides the population data, forested areas, proposed military settlements, and proposed roads also are included. Color is employed on the map.

Inquiries sent to a number of cartographers have failed to reveal earlier maps on which symbols such as dots or crosses, of equal size and value, are used, although a number of maps using graduated circles for differing values predate the 1863 New Zealand map. This is in itself perplexing in that what is regarded today as a more advanced cartographic technique apparently came to be employed first.

On present evidence, then, the New Zealand map of 1863 claims the honor of being the first to employ the dot method. Over the following half century, no further attempt was made in New Zealand to again utilize the technique.

* * *

(*) The writer wishes to acknowledge the assistance received from G.R. Crone, Royal Geographical Society, London; Walter Ristow, Library of Congress; and A.H. Robinson, University of Wisconsin.

(1) Smeds, Helmer, "A New Population and Settlement Map of Finland," *IGU Proceedings*, Washington, D.C., 1952, pp. 505-507.

ANNUAL MEETING
of the
ASSOCIATION
OF
AMERICAN GEOGRAPHERS

Miami Beach, Florida

April 22 - 25, 1962

ASSOCIATION AFFAIRS

BACK ISSUES OF *THE PROFESSIONAL GEOGRAPHER*

Inquiries are received from time to time as to the availability of previous issues of *The Professional Geographer*. In the belief that such information may be of interest to individuals, libraries, business concerns, government offices, and others wishing to fill out their files of the publication, the Editors have obtained the following tabulation of available back issues from the Central Office Manager of the Association.

Copies may be obtained by writing Mrs. Yetta G. Sternfeld, Central Office Manager, Association of American Geographers, 1785 Massachusetts Avenue, N.W., Washington 6, D.C. Some issues are very limited in quantity. Issues not listed are out of print. All volume and number data refer to the New Series; copies of the original series are not available.

PRICE: 50 CENTS PER NUMBER

Volume I, 1949: Numbers 1 (March), 2 (May), 3 (October).
Volume II, 1950: Numbers 2 (February), 3 (March), 6 (November).
Volume III, 1951: Numbers 1 (February), 2 (May), 3 (July), 4 (September), 5 (November).
Volume IV, 1952: Numbers 3 (May), 4 (July), 5 (September), 6 (November).
Volume V, 1953: Numbers 1 through 6 (bimonthly, beginning with January).
Volume VI, 1954: Numbers 2 (March), 3 (May), 4 (July), 5 (September), 6 (November).
Volume VII, 1955: Numbers 1 (January), 2 (March), 3 (May), 5 (September), 6 (November).
Volume VIII, 1956: Numbers 1 through 6 (bimonthly, beginning with January).
Volume IX, 1957: Numbers 1 through 6 (bimonthly, beginning with January).

PRICES 85 CENTS PER NUMBER; $5.00 PER VOLUME

Volume X, 1958: Numbers 1 through 6 (bimonthly, beginning with January).
Volume XI, 1959: Numbers 1 through 6 (bimonthly, beginning with January).
Volume XII, 1960: Numbers 2 (March), 3 (May), 4 (July), 5 (September), 6 (November).
Volume XIII, 1961: Numbers 1 (January), 2 (March), 3 (May), 4 (July).

NOTE FROM THE EDITORS

With this issue of *The Professional Geographer*, the Editors are launching an additional department in the New Publications section in which will be announced publication of selected new maps. The maps included will be single sheets, not atlases or classroom wall maps, that are unlikely to come to the attention of the majority of AAG members. The first such map announcement follows the book announcements in this issue.

Contributions to the new section are invited, for its continuation depends wholly upon voluntary cooperation by the readers. Contributors are requested to follow precisely the style and subheadings employed in the first announcement. If certain data are unavailable, include the subheading and follow it with the term unavailable.

Phyllis R. Griess, Editor
George F. Deasy, Associate Editor

ANNOUNCEMENTS AND REPORTS

GEOGRAPHY IN BULGARIA

During the last 18 months, the writer has continuously travelled and studied in Eastern Europe: Poland, the Soviet Union, Czechoslovakia, Yugoslavia, and Bulgaria. A portion of this time (May and June, 1961) was spent in evaluating the status of geographic teaching and research in the People's Republic of Bulgaria. The trip was proposed by two Bulgarian geographers, Professor Ignatov Penkov of the Department of Geography, University of Sofia, and Professor Trnko Jordanov of the Institute of Geography, Bulgarian Academy of Sciences. They personally helped with arrangements and travelled at times with the writer during his visits to scientific institutes in Sofia, and on trips to the Macedonian area of Bulgaria, to Plovdiv, Burgas, and Varna on the Black Sea, and to Trnovo. These trips represent the first time an American geographer has visited Bulgaria since the war.

Everywhere that the writer travelled in Bulgaria, he was well received, and great interest was shown in current American life and American scholarly activity. Schools, factories, and collective farms were visited, and in general there was complete freedom of movement despite the strained political situation which has existed between Bulgaria and the United States since the war.

Geography in Bulgaria, as in the Soviet Union and Poland (*The Professional Geographer*, March, 1961, pp. 34-36), is conducted through a dualistic organizational structure: the Institute of Geography in the Bulgarian Academy of Sciences, and the Department of Geography at the University of Sofia. All geography in Bulgaria at a professional or university level is concentrated in Sofia.

Institute of Geography. The Institute of Geography was formed within the Bulgarian Academy of Sciences in 1952. The Director is Professor G. Galabov; the Deputy-Director is Anastas Beshkov. At present, 27 people are employed in research. The Institute is formally divided into two main sections, physical and economic geography, and it is planned to add a new section for preparation of a Bulgarian national atlas.

The Institute publishes the *Journal of the Institute of Geography*, and also issues from time to time special reports to commemorate events or people of importance in geography. It is the writer's opinion that much work at the Institute is of a restricted nature and thus not made available to Western visitors.

An important and, from available proof copies, excellent publication is now under preparation in the form of a two-volume monograph entitled *The Geography of Bulgaria*. The second volume of the series is devoted to the economic geography of Bulgaria, and will be published sometime in early fall; the first volume, on the physical geography of the country, will appear in early 1962. The work is a joint effort of Soviet and Bulgarian scholars. Editors of the economic volume are A. Beshkov of the Institute, and Professor Valev of the Soviet Union; editors of the physical volume are Professor Gherassimov of the Soviet Union, and Professor Galabov of the Institute.

Department of Geography, University of Sofia. Geography as a separate subject was introduced at the University of Sofia in 1924. During the inter-war period, there was a total of five geographers at the University of which two were full professors.

At the present time, there are 19 people within the Department: four full professors, four docents, seven assistants, one librarian, and two technical assistants. The Department is divided into four sections: general physical geography, chaired by Professor Galabov; general economic geography, Professor Dinev; physical geography of Bulgaria, Professor D. Ivanov; and economic geography of Bulgaria, chaired by Professor I. Penkov. Geography is a part of the combined faculty of Biology, Geology, and Geography. The full faculty instructs a total of 1,044 students, of which 650 are enrolled in biology, 99 in geology, and 295 in geography.

In conformity with the present planning philosophy of the country, the number of students which enter the Department of

Geography each year is regulated by anticipation of how many will be needed five years later when their education is completed. Thus, the number of students in geography has steadily fallen, from approximately 500 immediately after the war to the present 295. It is expected that a planned increase in the number of years of required schooling at the high school level will again increase the number of students enrolled in geography at the University.

From 40 to 50 per cent of geography students at the University receive scholarship aid, which is given to those from families in which every member of the household earns less than 3,000 leva a year (tourist rate, $1.00/9.5 leva). Grants range from 250 leva a month during the first year, to 480 a month the last year. Upon graduation from the University, a student can expect to receive approximately 950 leva a month the first year with a gradual increase to about 1,200 leva after 15 years of service.

Though the writer was impressed by the general competence of the University geographical staff and its capacity for training of young geographers, he must state that, in his opinion, the inadequacies of research and publication facilities are severe handicaps. A number of issues of various journals have been published by the Department of Geography, but these have appeared sporadically and in too small a quantity. Moreover, library research materials in the form of Western, and especially American, journals and books are almost non-existent. Also, it would appear that there is little possibility for Bulgarian geographers to conduct research abroad, even in other socialistic countries, as only one person had been outside of the country (to the Soviet Union) for research purposes during a four-month period. However, regardless of official research possibilities, a large majority of the geographers that were met had travelled individually to various socialist countries, and some had visited Western Europe for short periods of time.

Mention must be made of an organization called the Bulgarian Geographical Society which is a semi-professional organization for the popularization of geography. The interest shown by the public in geography, through the activities of this group and the popularity of its journal, *Geography*, is most impressive.

It is the writer's opinion that the last 15 years have witnessed slow improvement and consolidation in the professional capabilities of geographers in Bulgaria. Research projects which have been initiated within the last two or three years indicate that we can expect an accelerated output in the number of first-rate scientific works from the professional geographers of the country.

Jack C. Fisher
Syracuse University

NEWS FROM GEOGRAPHIC CENTERS

LIBRARY OF CONGRESS, MAP DIVISION

During the current year, the Map Division of the Library of Congress acquired approximately 80,000 maps, 1,260 atlases, and numerous globes, three-dimensional models, periodicals, gazetteers, pamphlets, and miscellaneous cartographic publications for addition to its collections of some 2,500,000 items. A rather full report on the more significant acquisitions, with special emphasis on urban cartography, appears in the August issue of the *Library of Congress Quarterly Journal of Current Acquisitions*, Superintendent of Documents, Government Printing Office, Washington 25, D.C.

Reference services for the year totalled more than 15,000 and involved the use of some 85,000 items. Although primary responsibility is to serve Congress, services have been extended to other government agencies and to libraries or established scholars in all 50 states and 17 foreign countries. The extension of such services was through correspondence, inter-library loans, photoduplication, exhibits, and distribution of Division publications. Eight of the 18 staff members of the Map Division prepared 37 bibliographies or papers for publication this year.

The most significant and permanently enduring work is Mrs. Clara Le Gear's *List of Geographical Atlases in the Library of Congress*, of which Volume 6 is now in press at the Government Printing Office. It contains annotated entries and a detailed index to many atlases of Eastern Hemisphere

areas received in the Library of Congress since 1920.

The Assistant Chief of the Division, Dr. Walter Ristow, edited *A Survey of the Roads of the United States of America, 1789* by Christopher Colles, published by the Belknap Press of Harvard University Press, Cambridge, 1961. He also prepared a list of *Facsimiles of Rare Historical Maps Available for Sale*, which may be obtained free upon request to the Map Division. In addition, he completed a revised edition of *Aviation Cartography* and, in collaboration with Mrs. Catherine Bahn, prepared the Division's annual report on acquisitions. He has been responsible for a regular feature of the quarterly journal of the American Congress on Surveying and Mapping, called "Distinctive Recent Maps."

Charles W. Buffum has continued to prepare the annual report on maps made in the United States which is listed in the *Bibliographie Cartographique Nationale*.

Mrs. Catherine Bahn has prepared numerous articles for the Library of Congress' *Information Bulletin*, served as Book Review Editor for the SLA Geography and Map Division's *Bulletin*, compiled lists of educational maps for the *Journal of Geography*, and prepared a summary of equipment and arrangements for an idealized map library.

Richard W. Stephenson compiled an annotated *Bibliography of Selected Maps and Charts of Antarctica*, and in collaboration with Arch Gerlach presented an educational TV program on Civil War maps which is being published by the *Civil War Times*. Mr. Stephenson also has in press at the Government Printing Office an annotated bibliography of some 700 Civil War maps showing troop positions and movements, fortifications, and other military features of Civil War activity.

Richard S. Ladd prepared, and now has in press at the Government Printing Office, an annotated bibliography of some 300 selected maps showing exploration routes, early roads, and trails in the United States.

The Division Chief, Arch C. Gerlach, presented at the International Geographical Congress in Stockholm a paper on "Geography and Map Cataloging and Classification in Libraries." That paper has been published in the May-June, 1961 issue of *Special Libraries*. He also attended the International Congress of the History of the Discoveries at Lisbon in September, 1960, and there was appointed as United States member of an international committee to arrange for permanent preservation and improved reference use of rare historical maps and charts. He has continued to serve as Map Editor for the *Handbook of Latin American Studies*, and has prepared articles which have appeared in the *Geographical Journal*, the *Bulletin* of the SLA Geography and Map Division, and as monographs published by the Library of Congress.

During the summer of 1961, the Map Division employed nine graduate geography majors from several colleges and universities to help index, title, and file into the reference collections approximately 100,000 items which had accumulated in an unprocessed backlog. Among institutions represented were Dartmouth College, San Diego State College, Syracuse University, UCLA, University of Indiana, and University of Kansas; these acquired surplus duplicate maps and atlases for their collections. The Map Division purchased more than 260 new five-drawer map cases to hold additions to the collections.

PACIFIC COAST GEOGRAPHERS, ASSOCIATION OF

The APCG held its annual meeting on April 6 and 7, 1961, at the Downtown Center of San Francisco State College. Lyle Gibson (San Francisco State College) was in charge of local arrangements. All seven states in the Pacific Coast Division of the Association of American Geographers were represented among the 117 who registered.

The program, arranged by Edward T. Price (Los Angeles State College), consisted of 33 papers presented at four half-day sessions. Chairing the sessions were Andrew Kennelly (Long Beach State College), Walter Hacker (San Francisco State College), Joseph Spencer (UCLA), and Robert Newcomb (San Fernando Valley State College). At an evening session on April 6, a panel arranged and chaired by Harry Bailey (UCLA) discussed the topic, Graduate Training in Geography.

About half of the papers presented at the meetings dealt with topics or regions within the APCG area; other studies involved New Zealand, the United Kingdom,

Somaliland, Chile, China, Dominica, Finland, Pakistan, Panama, and Pennsylvania. Included were such subjects as highway planning, energy bases, plant ecology, physical changes of coasts, fog dispersal, trans-Sierra passes, political boundary problems, curricular geography, place names, recreation, transportation, land use, and factory farming.

Marion Marts (University of Washington) gave the presidential address on the topic, Can California Join the Union, at a Chinatown banquet.

Officers for 1961-62 are: President, Benjamin E. Thomas (UCLA); Vice-President, Harry Caldwell (Idaho); and Secretary-Treasurer, Dale E. Courtney (Portland State College).

SOUTHERN ILLINOIS UNIVERSITY

The Department has been approved to offer doctoral work, beginning with the fall term 1962. The Graduate School has established a special category of assistantships to be awarded to Ph.D. candidates.

David Niddrie, Lecturer at the University of Manchester, England, and David Christensen, Associate Professor at Florida State University, will be Visiting Lecturers during the 1961-62 academic year. Niddrie will offer work in geomorphology, physical geography, Africa, and the Caribbean lands. Christensen will handle cartography, a seminar on the Middle East, and the introductory undergraduate course in geography.

Niddrie's addition to the staff is part of an exchange program with the University of Manchester. Robert Harper, Chairman of the Department, will be at the University of Manchester during 1961-62. Joseph Velikonja will be Acting Chairman in Harper's absence.

Joseph Velikonja taught economic geography and the geography of the U.S.S.R. at the University of Wisconsin during the past summer. He also attended the annual meeting of the Italian Geographical Congress at Trieste in April as the official delegate of the AAG. He presented a paper on the Italian-born population of the United States.

Wilbur Zelinsky spent the past summer doing research on the geography of population at libraries in Chicago and New York. His article on the geography of religious denominations in the United States appeared in the June issue of the *Annals*, and his reviews have appeared in recent issues of *Economic Geography*, *The Professional Geographer*, and the *Geographical Review*. He participated in a panel on world population problems at the National Council for Geographic Education meetings in Cincinnati last fall, and organized a panel on the geography of population at the meetings of the Population Association of America in May.

Theodore Schmudde and Frank Thomas engaged in research under the Mississippi Valley Investigations program of the University during the past summer. Schmudde investigated flood plain soils, drainage, and land use in the Mississippi lowlands of Illinois and Missouri; Thomas studied the rail transport system of Southern Illinois.

Floyd Cunningham continues as Director of the University Laboratory of Climatology, and is collecting climatic data on Southern Illinois. He contributed a chapter, "Imaginative Teaching of Geography," to a recent volume on teaching published by Longmans, Green and Company.

Marjorie Shank spent her sabbatical leave travelling in Jamaica and studying at the University of Chicago during the winter of 1960-61.

Annemarie Krause offered a workshop in the geography of Latin America during the summer under the sponsorship of the University's Latin American Institute.

Patrick Tyson has accepted an appointment at Wisconsin State College, LaCrosse, Wis.

Nineteen graduate students were in residence during the 1960-61 academic year. Aulis Lind accepted an Assistantship at the University of Pittsburgh to do Ph.D. work, and Placido LaValle accepted a similar appointment at the University of Iowa. Francis Bennett has taken a position with the Pittsburgh Department of City Planning; Ronald Chaplin has joined the planning department of Moline, Ill.; Leland Newman has been appointed to the planning staff of Westchester County, N.Y.; William Rhodes has accepted a position with the planning commission of Sioux City, Ia.; and Richard RuBino has joined the staff of General Planning and Resource Consultants of St. Louis. These latter students are graduates of the planning specialty offered in geography with the cooperation of the Departments of Commu-

nity Development, Government, and Sociology.

Mary Galneder, Research Assistant, was employed by the Map Division of the Library of Congress during the past summer.

The Department was host to the West Lakes Division meeting last October. Over 100 persons attended the meeting. Included on the program were invited papers; a briefing session on the geography of Southern Illinois; and field trips in the Mississippi lowlands, the Southern Illinois hill country, and the dispersed urban population cluster of the Southern Illinois coal fields. High points of the meeting were an address by President Jan O.M. Broek, and a panel on water resources of the Middle West. The panel included John Borchert, Walter Kollmorgen, Edward Ullman, and Gilbert White, and was moderated by Charles C. Colby of the Mississippi Valley Investigations program.

Visiting geographers during the year included Jan Broek, Philip Wagner of the University of Chicago, Ake Sundborg of Uppsala, Frederick Simoons of the University of Wisconsin, and Clarence Odell of the Denoyer-Geppert Company. Sundborg spent four days working in the Mississippi River lowlands of Illinois and Missouri with Schmudde.

Charles Colby continues as Director of the Mississippi Valley Investigations program, an all-university research agency. He spent the summer of 1960 in Europe, devoting particular attention to the Rhine River in terms of its comparison with the Mississippi. He is working on two manuscripts, one dealing with the Rhine and one describing divisions of the Mississippi valley from source to mouth. The latter is an expansion of the paper he presented at the IGU meeting in Stockholm.

OTHER ITEMS

SLA Geography and Map Division Meeting

The Geography and Map Division is one of 16 Divisions of the Special Libraries Association which held its annual meeting in San Francisco, May 28 to June 1.

The Geography and Map Division program was arranged by its Vice-Chairman, Dr. Carl Mapes. Activities included an open house reception at the Rand McNally store in San Francisco, a visit to the California Historical Society where a fine exhibit of historical maps of California was discussed by the librarian, a full day trip to the Berkeley and Stanford campuses, and a business meeting.

At the University of California, visits were made to the Bancroft Library, the Map and Rare Book Rooms of the University Library, and to the Geography Department. At Stanford, the Bender and Hoover Libraries and the Geography Department were the principal objectives, but a brief talk on early California cartography by Dr. Joseph Williams highlighted the noon break between the campus tours.

At the business meeting of the Division, an Honors Award was presented to Dr. Arch C. Gerlach, Chief of the Map Division and Incumbent of the Chair of Geography at the Library of Congress, for his outstanding contributions to the fields of geography and map librarianship. Among his accomplishments in recent years were cited the organization of summer projects to employ university geography majors at the Library of Congress; service as the United States member on the IGU Commission to study the Library Classification of Geographical Books and Maps; preparation of lectures, exhibits, and papers on cartography and kindred subjects for professional journals; encouragement of his staff to participate in the compilation of bibliographies, and in activities of professional organizations; and services as past-chairman of the Geography and Map Division, as a member of the SLA Executive Board, as Chairman of the NAS-NRC Advisory Committee on Geography to the Department of State, as a member of the National Atlas Committee, and as United States representative on the Directing Council of the Pan American Institute of Geography and History.

The SLA Geography and Map Division also expressed deep appreciation to George Dalphin at Dartmouth College for editing and improving the Division's quarterly *Bulletin*, to Richard Ladd for assembling and mailing it, to Charles Buffum for selecting

and preparing bibliographic notes on 171 new maps and atlases for the *Bulletin*, to Mrs. Catherine Bahn for preparing an excellent report on equipment and arrangement of map libraries, and to Dr. Walter Ristow for his continuing effort to bring together and to prepare sections for the *Guide to Cartographic Research* which will be published by the SLA next year.

TEMPORARY IMPORTATION OF PROFESSIONAL EQUIPMENT

The Information Service, European Office of the United Nations, Geneva, announces that a new international Convention, designed to ease the temporary importation of professional equipment, has been completed and opened for signature by governments on June 8, 1961. This treaty, the Customs Convention of the Temporary Importation of Professional Equipment, was prepared under the auspices of the Customs Co-operation Council, an intergovernmental organization at Brussels, and the Contracting Parties to the General Agreement on Tariffs and Trade (GATT), in consultation with UNESCO.

The Convention provides, among other things, for the temporary admission, without paying customs duties, of a wide range of equipment needed by persons visiting foreign countries for the exercise of their profession. This would include the equipment imported by specialized scientists, such as experts for undertaking topographical surveys. The United States is not yet (July 18, 1961) signatory to the Convention.

Gordon G. Darkenwald, member of the AAG, died on July 4, 1961 at the age of 55. His wife predeceased him by only a week. Dr. Darkenwald was a graduate of Valley City (North Dakota) Teachers College, and received the M.A. (1933) and Ph.D. (1934) from Clark University. He had been a member of the Geography Department faculty at Hunter College since 1934, and for some years served as Departmental chairman. He was co-author of Economic Geography **(Macmillan).**

William Vaughan Lewis, Visiting Professor of Geography at the University of Chicago, died June 8, 1961, while in the United States. He was University Lecturer in Geography at Cambridge University and was a Fellow at Trinity College. His major contributions were in coastal physiography and glaciology.

Erhard Rostlund, member of the AAG, died July 13, 1961. A native of Sweden, he joined the staff of the Geography Department at the University of California, Berkeley, in 1946, where he received his Ph.D. degree in 1950. He was Associate Professor at the time of his death. His publications dealt with the geographical aspects of fish and wildlife, forests, and Indians.

Thomas M. Williams, member of the AAG, died June 24, 1961 at the age of 26. He received his bachelor's degree from the University of Illinois in 1958, and his master's degree from Southern Illinois University in 1961.

COMMUNICATIONS FROM READERS

TEACHING LOADS IN BRITAIN

Dear Editor:

Academic geographers in many parts of the world will read with great interest and attention Professor Guy-Harold Smith's analysis of the conditions of employment of their American colleagues (*The Professional Geographer*, Vol. XIII, No. 3, 1961, pp. 11-16). The general picture is one familiar in Britain – the teaching load tends to be heavier in the smaller institutions with smaller staffs required to cover broadly the same general undergraduate curriculum. In this country, with rare exceptions, salary scales are the same in all universities so that the attraction of the larger for the best men is not financial but related to the lessened burden of routine work. The broad general aim of all, however, is tending towards a maximum of eight hours.

But one matter here regarded as of fundamental importance is not mentioned. It is the spread of the teaching hours. Eight hours spread widely over five days of the week (Saturday work is now rare) is a far greater burden than if concentrated in three, leaving two working days completely free for research or other activities.

Another aspect of university work appears to be very different. An American professor commonly refers to his "office" and is often expected to keep office hours; many of his British colleagues prefer to do their writing at home, especially if they live some distance out, and appear at their college rooms only three or four days of the week. In Britain, too, where formal teaching beyond the bachelor's degree is rare and graduate students expect to receive individual attention, this can be arranged at irregular times, frequently in the evenings, to suit mutual convenience.

When making an appointment to a senior post, the selectors are frequently required to state that the successful candidate has proved himself as a teacher, as a researcher, and as an organizer. Few individuals balance these three qualities equally; hence, the general tendency to allow, or indeed encourage, special aptitude in whichever of the three fits the particular man.

In recent years, another aspect of university life has loomed large, namely, the calls made by government departments and public bodies on the services (nearly always unpaid) of the university staffs. A professor may well find 80 per cent of his time devoted to such work. It would be interesting to know how far British conditions are paralleled in other countries.

L. Dudley Stamp
Bude Haven, Cornwall, England

REGIONAL TERMINOLOGY

Dear Editor:

The proliferation of new views and concepts in the study of regional geography has made imperative the need for clarification and definition of terminology. I, therefore, set forth the following definitions of some of the terms in common usage in regional studies. While in no sense are these definitive, I would be pleased if they would generate an outpouring of serious discussion.

Regional Science – the construction of Isard-lines. *Microgeography* – the distribution of angels on the head of a pin. *Macrogeography* – the distribution of angels. *Desire Lines* – streetcar tracks in New Orleans. *Region of Uniformity* – an army camp. *Region of Relative Homogeneity* – living with the in-laws. *Compage* – a type of fertilizer production. *Natural Land Type* – hillbilly. *Natural Land Association* – Sierra Club. *Geographical Association* – AAG. *Nodal Region*–delicious with cheese. *Complex Nodal Region* – delicious with cheese and eggs. *Specific Region* – Oceania. *Generic Region* – inhabited by chromosomes. *Hinterland* – a gossip columnist's beat. *Discontinuous Hinterland* – a part-time gossip columnist's beat. *Umland* – home of the . . . *Foreland* – a golf course

Nested Hierarchy – a matriarchal society. *Regional Hierarchy* – the pecking order. *Spatial Interaction* – see "Quantity and Quality in Geography." *Regional "Character"* – village idiot.

Robert W. Kates
University of Chicago

CHANGING EMPHASIS IN GEOGRAPHY

Dear Editor:

Between 1900 and 1960, the major emphasis of geographers' thinking has shifted. In 1900, stress was placed on physical geography, and in the 1920's on regionalism. In recent years, geographers have expressed dissatisfaction with regional geography and have accented a broader approach via functional, systematic, historical, and applied studies. Regional geographers appear to be embracing quantification within both limited and general frames of reference, and such a trend will doubtless produce new advances; yet, some scholars feel that "excessive enthusiasm for quantification tends to sanctify error and multiply trivia, while clarity and universality vanish" (Lowenthal, D., *The Geographical Journal*, Dec., 1960).

Today, geographers can be grouped around four major fields of concentration: natural sciences, in which nature is the active agent; social sciences, in which man is the forceful doer; the sphere of techniques, such as cartography; and the realm of regionalism, which provides a positive check against systematism. Hence, the cry that geography lacks substance in comparison with other disciplines seems highly unrealistic.

In considering the word geography itself, views also have changed over time. Marsh described geography as a link between the systematic sciences, a method of synthesizing materials rather than a field with unique subject matter. The idea that geography is specifically concerned with relations between nature and man likewise is traditional. With the present admission within the discipline of the notion of diversity, there appears to be a need for less semantics and more acceptance of a broader definition, i.e., geography represents the study of the earth's surface.

Naturally, with freedom of expression comes responsibility, and geography is no exception. The obligations of geography pertain to the domains of cartography, orderly descriptions of the surface of the earth, and correlation of man-land relations. Let us realize these responsibilities and not become carelessly sidetracked or bogged down by excess enthusiasm for minutiae.

Recently, Hans Carol expressed a relevant view concerning what there is left for geographers to accomplish. "It is the assembling of the results yielded by other sciences in order to achieve an understanding of the complex reality of the total earth shell . . . it is not sufficient to assemble the findings of the systematic sciences . . . a specific process of analysis and synthesis must follow" (*The Professional Geographer*, Jan., 1961). Today, the approach of geography, in compliance with the exigencies of the times, is a comprehensive one. There are simultaneous demands for the services of the economic, cultural, and political geographer, and for systematic as well as functional studies. Geographers have joined in association with geophysicists, ecologists, and historians. As Fenneman once stated, "Where is the common ground on which such diversity can meet? Interest in places, areas, regions is the common bond" (*Annals of the Association of American Geographers*, 1919).

Ray Y. Gildea, Jr.
Louisiana State University

NEW PUBLICATIONS

Energy in the American Economy, 1850-1975: Its History and Prospects. SAM H. SCHURR, BRUCE C. NETSCHERT, AND OTHERS. The Johns Hopkins Press. Baltimore. 1960. xxii and 774 pp. illust. $12.50.

The authors present a very thorough report on the growth, composition, and sources of United States energy consumption during the last 100 years. Based on this evaluation of the past, and in consideration of the future growth of population and the Gross National Product as well as anticipated changes in techniques and habits (for example the spread of air conditioning), the authors make forecasts regarding the volume and sources of energy demand and supply in 1975. Due to the nature of much of the statistical material, and in view of the aim of the authors to deal with the United States as a whole, only very limited information on regional patterns of energy consumption and supply is given. Despite this limitation, the book, with its prolific statistical data, should be of great interest to specialists in the geography of North America and industrial location. It will definitely appeal to all concerned with conservation and resource policy.

To present their material clearly, the authors had to evolve a new economic and geological classification of minerals, utilizing the terms resource base, resources, and reserves. Although most of the available statistical data do not fit into this new classification scheme, this reviewer believes that the concepts of the scheme merit attention and are particularly suitable as a teaching device. Thus, the petroleum resource base includes all potential oil bearing rocks down to a depth of 65,000 feet, but not down to the Mohorivic discontinuity. For the United States, the resulting resource base is estimated at about 500 billion barrels. Known resources are estimated at 175 billion barrels. No estimates for reserves, as defined here, are given, for the authors regard the current industry measurement of proven reserves only as a working inventory containing about 12 years supplies. However, based on their analysis, the authors believe that a domestic supply of about 6 billion barrels should be available at present costs in constant dollars in 1975, which would more than cover demand for that year which is estimated at 5.2 billion barrels. For this reason, imports of foreign oil are not held to be necessary as a domestic conservation measure. Similarly, more than sufficient coal and natural gas are estimated to be available for consumption in 1975.

To arrive at their consumption estimates for 1975, the authors calculate that total energy consumption will increase at a rate of 3.2 per cent per year. This figure is based on a per capita increase of 1.4 per cent and a decrease of 0.8 per cent per unit of the estimated Gross National Product of the United States. In detail, coal consumption is estimated to increase by 74 per cent, oil by 95 per cent, and natural gas by 107 per cent. Due to lack of data, the 1975 impact of atomic power production cannot be evaluated. However, if atomic power were to supply between 10 and 15 per cent of the United States electricity output in 1975, this would decrease the growth of coal consumption to between 50 and 58 per cent without significantly affecting other sources of energy. For lack of economic data, the future impact of oil shale production also cannot be evaluated.

The chapters on past uses of energy contain some material of interest to geographers. Although the first commercial coal was shipped from the James River District of Virginia to New York City in 1758, difficulties of inland transportation made gas works on the east coast of the United States dependent upon imported British coal rather than American coal until the 1850's. A few years later, oil began to compete with coal gas for illumination, and thus coal was never as significant in the rapidly developing economy of the United States in the 19th century as it was in Europe. Indeed, oil soon became the kingpin of the American economy, for, only five years after the beginning of commercial oil production in 1859, petroleum products ranked sixth among American ex-

ports. Due to the greater energy content of oil, railroads located far from coal mines began using oil in the 1880's, although, as in the case of California, this resulted in imports of fuel oil by ship all the way from Pennsylvania around Cape Horn. These historical examples explain that availability of resources within a country does not always determine use, and that geography working through distance, relief, and transportation systems can make utilization of imports more economical than consumption of local materials.

ALEXANDER MELAMID
New York University

Economic Atlas of Manitoba. THOMAS R. WEIR, ed. Department of Industry and Commerce, Province of Manitoba, Canada. Winnipeg. 1960. v and 81 pp. illust. $15.00 (standard edition); $20.00 (deluxe edition).

The Province of Manitoba and the geographers, mostly from the University of Manitoba, who contributed to the preparation of this atlas may justly be proud of the publication. It is an excellent product which the reviewer hopes may set an example that will stimulate preparation of similar atlases for other areas.

The volume is large; over-all page dimensions are 17 x 22½ inches, which makes it somewhat unwieldy to handle. However, its largeness endows it with the great virtue of permitting reproduction of large-sized maps on which details stand out clearly, thus obviating the necessity of employing a magnifying glass to use the maps.

Topics covered in the atlas include various aspects of the following: environment, population and settlement, and resources and their uses. There are 37 full-page plates containing 100 colored maps, together with textual material and photographs relevant to the data presented on the maps. The last two pages of the atlas contain a section on facts about Manitoba, and a gazetteer and glossary.

P.R.G.

A History of the United States Weather Bureau. DONALD R. WHITNAH. University of Illinois Press. Urbana. 1961. ix and 267 pp. $6.00.

Ninety years of scientific and administrative progress, coupled with political and economic frustrations, are detailed in this objective history of the United States Weather Bureau. Beginning with events leading to creation of the first national weather service in the Army Signal Corps in 1870, Whitnah meticulously chronicles both the political harassments and the dedicated public service which have accompanied the growth of the Weather Bureau to the present. One measure of that growth is the increase in Congressional appropriations, from $15,000 for the fiscal year 1871 to $57,555,400 in 1961. Another is in the absorbing story of the Bureau's expanding techniques and services, from rain gauges to weather satellites and from one-day probability forecasts to forecasts of atomic fallout.

A History of the United States Weather Bureau is exactly that; it is not, nor does the author claim it to be, a history of meteorology in the United States. Political weather and the climate of public opinion are its major concerns, into which is interwoven a relevant account of technological developments and research contributions by Weather Bureau personnel.

The author has documented his work thoroughly. Very few pages are without footnotes. The bibliography includes numerous unpublished papers, as well as newspaper and magazine articles and meteorological monographs. The volume is exceptionally well indexed.

Earth scientists will find this book a useful reference and an enlightening commentary on the trials of a government agency devoted to science. For students contemplating a career in the Weather Bureau it is required reading.

HOWARD J. CRITCHFIELD
Western Washington College of Education

Statistical Geography: Problems in Analyzing Areal Data. OTIS D. DUNCAN, RAY P. CUZZORT, AND BEVERLY DUNCAN. The Free Press of Glencoe, Ill. Chicago. 1961. vi and 191 pp. illust. $6.00.

This first published book in the United States on the youthful field of statistical geography is written, strangely enough, not by geographers nor even by statisticians, but by a group of sociologists. The writers — Otis and Beverly Duncan, respectively

Associate Director and Research Associate at the Population Research and Training Center, University of Chicago; and Ray Cuzzort, Assistant Professor of Sociology, University of Kansas – recognize the incongruity of their authorship, but express the hope that geographers may learn from their efforts as they in turn have profited from the contributions of geographers in the field of statistical areal analysis. Indeed, they offer the geographic profession "perspective by incongruity."

The book is primarily a methodological presentation of selected concepts and analytical techniques that have been developed by investigators from a variety of disciplines – plant ecology, agricultural economics, urban sociology, economic geography, and others – whose interests converge on the statistical evaluation of areal differentiation. Abbreviated listings of the contents of each of the three chapters will give some concept of the scope of the book.

Chapter One, Preliminaries, deals with parallel and converging developments, perspectives on areal differentiation, and the scope and purpose of the monograph.

Chapter Two, Areal Units and Areal Data, investigates such units insofar as they represent: (1) a collection of items, (2) a segment of space, (3) a site or location, and (4) a member of a set; and, further, (5) probes their relationships to other units. The chapter also discusses types and quality of areal data.

Chapter Three, Analysis of Areal Data, is concerned with "questions arising in the actual manipulation of quantitative areal data by statistical methods." Its subdivisions are titled: aggregation of areal data; measurement of areal distributions; analysis of spatial structure; explanation of areal variation; contiguity and regional classification; and temporal aspects of areal variation.

A concluding bibliography contains a listing of some of the more worthwhile readings in the methodology of statistical geography. Noteworthy is the relatively limited number of references to works by geographers or those published in what might be termed the literature of geography, and the relative stress placed on contributions from sociology and economics.

For the geographer who is untrained in the field of statistical geography, but who wishes to gain an insight into the philosophy, scope, and methodology of the field, this book is a welcome gift for it brings together within one cover the essence of many contributions that are widely scattered throughout the literature of a number of disciplines. A knowledge of mathematics and statistics is not essential to the understanding of most of the first two chapters, but much of the last chapter is unintelligible without some training in quantitative manipulation.

G.F.D.

An Introduction to Geography. RHOADS MURPHEY. Rand McNally and Co. Chicago. 1961. 699 pp. illust. $7.75.

Rarely does a college textbook come along that is not only a scholarly gem but a joy to read. This is such a book. Originally titled *Man on the Earth* before publication, this volume treats of the interrelationships between culture and nature. Though there are two grand divisions within the book – the first, analytic; the second, synthetic – man is the constant focal point.

The first part of the book covers the ground we usually associate with physical elements of geography. But Murphey does not deal with these as abstractions; rather, he weaves man into the pattern. Grasslands, for example, are seen as zones of human movement, and forests as barriers. To illustrate these points, the author employs a quality of writing worthy of our better novelists. Genghis Khan on the steppes of Asia, or Robin Hood in Sherwood Forest, are typical examples of how man's relations to nature can be made exciting for the reader. There is no slighting of scientific fact; instead, natural truths become more vivid when fastened to human existence.

The second half of the book reflects the current trend of utilizing case studies to illustrate major geographic concepts. Murphey's selection of areas is excellent, and the topics are varied. These in-depth studies include cultural problems, mainly, such as those associated with settlements, geopolitics, and economic geography.

In both sections of the book, Murphey stresses the importance of viewing landscapes in historic perspective. Cultural and historical geographers will welcome an introductory text that displays a willingness on the part of the author to probe deep into time. Only in that way can we really

understand how the physical and cultural landscapes came to be what they are today.

Maps, diagrams, charts, photographs, and tables are well constructed and organized. Color is employed in some instances. Statistics are kept at a minimum in the body of the text, but are adequately handled in the comprehensive appendix. This book should stimulate the student as well as the teacher to think, something long overdue in elementary geography classrooms.

ROBERT H. FUSON
University of South Florida

A Geography of Europe Including Asiatic U.S.S.R., 2nd edition. GEORGE W. HOFFMAN, ed. The Ronald Press Co. New York. 1961. ix and 815 pp. illust. $9.50.

To all geographers who are familiar with the first edition of this publication, the new edition will be most welcome. The book, which is the combined product of nine geographers including the editor, contains 10 chapters and an appendix. Topics treated include a general introduction to Europe, and the continent's physical, biogeographical, and historical background. This material is followed by discussions, in which the political and economic aspects of geography are stressed, of the major divisions of the continent – the British Isles, and Northern, Western, Southern, and Eastern Europe. Chapter 9 is concerned with the Soviet Union. The final chapter deals with Europe's position in the world, particularly from the economic and political viewpoints. An appendix contains pertinent geological information, selected climatic data, and statistical tables on a variety of topics – population, areas, commodity production, land use, trade, and other items. The book is comprehensive, and contains a considerable number of useful maps, diagrams, and photographs.

P.R.G.

Case Studies in World Geography: Occupance and Economy Types. RICHARD M. HIGHSMITH, JR., ed. Prentice-Hall, Inc. Englewood Cliffs, New Jersey. 1961. vi and 218 pp. illust. $3.50.

The title of this volume is certainly indicative of its content. The work is divided into six parts involving a total of 29 case studies. The parts are organized on the basis of occupance and economy types, and include agriculture, biotic resources, minerals, recreation, manufacturing, and urban functions.

The book is designed as a companion volume for standard texts on world geography; it provides the student with examples of detailed geographic studies. It should work equally well with either regionally or topically oriented introductory courses. There are, perhaps, too many case studies based on Anglo-American and European locales, since only 11 of the studies are outside of those areas.

Five authors, all from Oregon State University, have contributed to the work. They have done a fine job of writing, and each case study is well organized under appropriate headings and subheadings. The articles average seven pages in length, and are illustrated with significant maps. The contributors have properly drawn heavily upon articles from a wide array of professional journals and from government publications. These sources are duly credited in footnotes, thus presenting a meaningful bibliography to the interested student.

MALCOLM A. MURRAY
Miami University

The West Virginia Redevelopment Plan for Webster County. Planning and Research Division, West Virginia Department of Commerce. Charleston. 1961. 39 pp. illust.

The West Virginia Redevelopment Plan for Webster County is the first of two such inventories being prepared by the West Virginia State Department of Commerce with the hope of utilizing the study to take advantage of the Area Redevelopment Act recently passed by Congress.

The purpose of this study is to determine the extent of economic decline in Webster County, the factors responsible for the decline, and the resources which the county has available for development; and finally to suggest ways in which the county's resources may be used to further its economic development.

The publication is divided into three parts of which Part Three, Economic Inventory, probably is of greatest interest to most geographers. Maps in this section depict types of soils and of forests, mineral

resources, transportation facilities, population distribution, housing, existing land use, and community facilities. Slightly more than half of the publication is devoted to textual material, much of it treating and supplementing the data shown on the maps.

One of the principal values of the publication, at least to non-residents of Webster County, is that it provides an example of a type of geographic study that can be made on a county basis for a very practical purpose – rehabilitation of the County's economy.

P.R.G.

Imago Mundi: A Review of Early Cartography. Vol. XV. E.R. ROUKEMA AND R.A. SKELTON, eds. Mouton and Co. 's-Gravenhage, The Netherlands. 1960. 125 pp. illust. $14.50. Available in the United States from Henry Stevens, Son and Stiles, Albee Court, Larchmont, N.Y.

The publication of Volume XV of *Imago Mundi* in 1960 has given some reassurance to scholars that the world's outstanding journal in the field of historical cartography will be continued despite the death of its founder, Dr. Leo Bagrow. Between 1935 and 1956, he produced 13 volumes which reflected his own high scholarly standards, personality, and wide contacts in this field. After Dr. Bagrow's death in 1957, Captain E.R. Roukema became Secretary-Editor for *Imago Mundi*. With the help of R.A. Skelton of the British Museum as Consultant Editor, he published Volume XIV, completed final proofs for volume XV, and forwarded to the printer materials for Volume XVI before his death in April, 1960.

Volume XV is a real tribute to the founder of this journal, as well as to Captain Roukema and Mr. Skelton. It contains 44 plates, many of which are high quality facsimiles of rare historical maps, lengthy articles by 14 authorities on early maps, six short articles, and some reviews of recently published works in historical cartography. Some titles of articles, selected at random in Volume XV, indicate the scope of this volume: The Map as a Vehicle of Mexican History; Marshall Islands Navigational Charts; The Reputed Inclusion of Florida in the Oldest Nautical Maps of the World; A List of Nagasaki Maps Printed During the Tokugawa Era; and Pieter van den Keere (Petrus Kaerius) 1571-1646 (?). There are also notes on unusually significant historical maps recently acquired by the Bibliotheque Nationale at Paris, maps of Wolfgang Lazina in the Tall Tree Library at Jenkintown, Pa., and some maps in the Correr Museum at Venice. Ena Yonge, of the American Geographical Society, provides a list of early globes to supplement those mentioned in the International Catalog of Early Globes, published in Volume XII, 1956.

Following the death of Captain Roukema in 1960, Fru Bagrow transferred the rights of *Imago Mundi* to Professor Roberto Almagia of Italy. He has appointed a management committee consisting of himself, G.R. Crone, Marcel Destombes, Mlle. M. Foncin, George Kish, and R.A. Skelton to assure continuation of *Imago Mundi*. The management committee expects publication of Volume XVI late in 1962 and is negotiating a contract with a new publisher in addition to seeking foundation support and greater circulation for this high quality journal.

ARCH C. GERLACH
The Library of Congress

Statistical Abstract of Latin America. Center of Latin American Studies. University of California. Los Angeles. 1960. vi and 48 pp. $2.00 (single); $1.00 (10 copies or more).

This is the fourth *Abstract* to be published by the UCLA Center of Latin American Studies and contains information generally for the year 1958, although some 1959 data appear. This marks the first issue that carries the publication date on its cover rather than the date of the source material. Hence, there is no informational gap between this volume and the last one that appeared.

The *Abstract* has 19 plates of statistical material concerning: area and land use; population (size, distribution, vital statistics, sex, cultural characteristics); social organization (education, health, social security, cultural facilities); labor force; production (forestry, fishing, animal husbandry, agriculture, minerals, electricity, industry); transportation-communication (shipping, railways, airways, motor, telephones); finance; United States investments; and foreign trade.

Entities covered in the *Abstract* are the

20 Latin American republics and most dependent western hemisphere areas. United States, Canadian, world, and Latin American regional totals are given to facilitate comparisons. In essence, this is a statistical abstract of the western hemisphere.

The volume is accurate, up-to-date, and easy to use. The student, teacher, or researcher might search for many hours in the best of libraries and still not collect the quantity or quality of data presented in this little book. Not the least to recommend it is its modest group price. The *Statistical Abstract of Latin America* should be an indispensable supplement in any Latin American area course, be that course in geography or some other social science.

ROBERT H. FUSON
The University of South Florida

The West Indies Federation: Perspectives on a New Nation. DAVID LOWENTHAL, ed. Research Series No. 23, The American Geographical Society. Published in cooperation with The American Geographical Society and Carleton University by Columbia University Press. New York. 1961. viii and 142 pp. $3.00.

As stated in the Preface, this book is designed "to introduce the general reader – not the West Indian expert – to the economic, political, and social background" of the islands comprising the West Indies Federation. The volume consists of four essays written by four different authors: a West Indian, H. W. Springer; two Canadians, Gordon Merrill and Douglas G. Anglin; and one American, David Lowenthal, who also is editor of the book.

The titles of the four essays are: The West Indies Emergent: Problems and Prospects; The Survival of the Past in The West Indies; The Political Development of The West Indies; and The Social Background of West Indian Federation. Also included in the publication are a map of the West Indies, designating the islands that are members of the Federation; tables presenting data on area, population, vital statistics, trade, production, finances, and income; and a selected West Indian reading list.

This up-to-date book dealing with a newly emerging nation should prove of special value and interest to Western Hemisphere geographers, as well as to others of the profession whose interests include Western Hemisphere geography.

P.R.G.

A Quantitative System for Classifying Landforms. WALTER F. WOOD AND JOAN B. SNEIL. Technical Report EP-124, Environmental Protection Research Division, Quartermaster Research and Engineering Center. Natick, Mass. 1960. iv and 24 pp. illust.

The purpose of this brief Quartermaster study is, in the authors' words, to construct "a simple, but expressive, landform code, based on measurements from topographic maps, [to permit] concise descriptions of any part of the earth's surface." Six terrain factors are used as the basis for classification: topographic grain, relief, average elevation, elevation-relief ratio, average slope, and slope direction changes.

The study is divided into two parts. The first discusses the quantitative derivation of each terrain factor, and gives examples from central Europe to illustrate their application. The second part, of special interest to geographers, uses the classification system to delineate landform regions. The authors' application of quantitative criteria shows that it is possible to derive regions which are similar (but seldom identical) to those which Van Valkenburg and Lobeck described in qualitative terms for central Europe.

Some readers may feel that the authors' twelve-digit landform code is too cumbersome to be useful. Real landscapes, however, are seldom as simple as hypothetical models, and, if a description must be long in order to be accurate and meaningful, it cannot be helped.

It is hoped that this provocative paper will receive wide distribution. Regional geomorphology has too often suffered from an overabundance of fuzzy descriptions, and the use of quantitative definitions may help to sharpen our ideas about differences and similarities between various landscapes.

PEIRCE F. LEWIS
The Pennsylvania State University

Crossroads: Land and Life in Southwest Asia. GEORGE B. CRESSEY. J.B. Lippincott Co. Philadelphia. 1960. xiv and 593 pp. illust. $8.95.

Crossroads is by now so well known to

members of the geographic profession that its inclusion within a listing of new publications would appear unnecessary. Nevertheless, this reviewer wishes to publicly add his voice to the chorus of praise for this latest product of a renowned geographer. Cressey has performed a superb job of geographical analysis on one of the world's most complex regions, and the product will become a classic in its field.

It is needless to point out to the main readership of this periodical the scope and content of the book, but, for the benefit of the few subscribers who may not have had the pleasure of leafing through its pages, a brief synopsis of its organization follows. Part One, nine chapters in length, presents a systematic overview of the major geographic facets of Southwest Asia (termed Swasia by the author): place, people, land, climate, rivers, land use, mineral resources, oil, and international contacts. Part Two, comprising eight chapters, analyzes individually the component national units, or groups of units, comprising the area: Turkey, Arabia, Egypt (even though not a part of Swasia), Iraq, The Levant, Israel, Iran, and Afghanistan. Each chapter is followed by a comprehensive listing of the more readily accessible English-language sources; and these entries, in the aggregate, form the most complete published bibliography available on the geography of the area. Dozens of original maps, and hundreds of superb photographs, lavishly supplement the text; indeed, few are the pages without at least one illustration. Tabular statistical materials and a glossary of Arabic, Persian, and Turkish words also are included.

Crossroads is a fitting successor to *China's Geographic Foundations, Land of the 500 Million: A Geography of China, Asia's Lands and Peoples* and other books of similar caliber from the pen of one of the world's foremost authorities on Asia.

G.F.D.

The Finger Lakes Region: Its Origin and Nature. O.D. VON ENGELN. Cornell University Press. Ithaca. 1961. 156 pp. illust. $4.50.

The Finger Lakes region of central New York State provides a fascinating display of erosional and depositional features associated with Pleistocene continental glaciation. Moreover, development of the eastern group of lakes appears to be unique. Von Engeln, Emeritus Professor of Geology at Cornell University, has written an excellent, and the only, account of the glacial geology of the region. Although the southern Cayuga Lake drainage area receives most attention, the entire region is adequately treated and even glacially significant peripheral locations are covered.

Topical chapters include such subjects as preglacial structures and their dissection, distinction between eastern and western Finger Lakes, hanging and through valleys, rock gorges, so-called high-level Finger Lakes, and glacial deposits. Adequate and clear illustrations include photographs, maps, and block and physiographic diagrams. In addition to the main body of the book, there is an epilogue, devoted chiefly to support of the continental uplift theory as the cause of ice ages; brief statements concerning some outstanding vantage points and excursions; a list of the names of local USGS 7½-minute maps, together with an index map; a glossary; references; and an index.

The few shortcomings are chiefly of an editorial nature. Maps and physical diagrams would be more useful if scales and compass orientations were included. More frequent reference to illustrations, likewise, would be helpful. Incidentally, there is no East Cortland (p. 116).

By itself, this regional physical study provides absorbing reading for the geographer. Its value obviously is enhanced by reference to appropriate topographic sheets and a good road map.

ROGER C. HEPPELL
State University of New York, Cortland

Essentials of Effective Writing. V.F. HOPPER AND C. GALE. Barron's Educational Series, Inc. Great Neck, N.Y. 203 pp. $1.50 (paper); $3.50 (cloth).

Practice for Effective Writing. V.F. HOPPER AND C. GALE. Barron's Educational Series, Inc. Great Neck, N.Y. 160 pp. $1.50 (paper).

This college textbook on effective writing, and its accompanying practice book, arrived most fortuitously immediately after publication, in *The Professional Geographer*, of Floyd's article on "Toward a More Literary Geography" (Vol. XIII, No. 4, July, 1961, pp. 7-11). For those in the geographic profession who personally took to

heart the admonitions and advice offered by Floyd, the above paperbacks offer an effective but inexpensive remedial course in correct writing.

Contents of the textbook deal not only with such expected topics as the proper use of words, sentence structure, paragraphing, and punctuation, but also are concerned with logic and clarity of expression, emphasis, consistency, and appropriateness. A concluding section, entitled The Writer's Approach to His Subject, is an abbreviated but excellent guide to the proper preparation of a manuscript. The subject matter of the book is well organized and indexed, so that it can be effectively used not only for study purposes but also as a reference handbook.

The practice book, which may be purchased separately, provides a series of 78 exercises wherein the reader of the textbook may apply the principles he has learned.

In combination, the two books offer a complete self-teaching course on basic writing techniques. Most geographers, including the reviewer, without doubt can profit materially from such a course.

G.F.D.

Fundamentals of Earth Science, 2nd edition. HENRY D. THOMPSON. Appleton-Century-Crofts, Inc. New York. 1960. xiv and 466 pp. illust. $5.50.

The increased attention to scientific education which followed World War II, and which was renewed after Sputnik, brought a corollary increase in the emphasis on "earth science" as a synthetic discipline. New courses and even new curricula were introduced to meet growing demands, prompting in turn the publication of increasing numbers of textbooks in the new subject. The quality of these texts, however, has been notably uneven. Too many authors apparently have found it impossible to combine geology, meteorology, astronomy, and sometimes cartography under a single cover, and to give each subject an accurate and reasonably balanced treatment. Henry D. Thompson in this second edition of his 1947 book has come closer than most, and his book is one of the best introductory earth science texts available today.

Even so, the book has a strong geological bias. Of its 27 chapters, fully 18 deal with physical geology, and two others with historical geology and paleontology. The introductory chapter, titled Scope and Development of Earth Science, is mainly concerned with the development of geologic thought. Only three chapters are devoted to meteorology and climatology, two to astronomical aspects of the earth as a planet and origin and age of the earth, and one to cartography and aerial photography. A concluding chapter deals with Useful Aspects of Earth Science.

The book is beautifully illustrated – not only with the handsome photographs of landscape which have increasingly characterized recent geological textbooks, but also with a number of excellent aerial photographs (including several less excellent stereo-pairs), and block diagrams by A.K. Lobeck, Erwin Raisz, and others. Many of the illustrations are so good, in fact, that they deserve longer and more enlightening captions than the author has provided.

The book is clearly and succinctly written. Perhaps its most admirable trait, however, is the careful and scholarly treatment of subject matter – an unusual attribute in an introductory textbook with so wide a scope. Although discussion of individual topics is necessarily brief, controversial matters are handled with special care. For example, the presentation of alternative hypotheses to account for the origin of the earth is admirable, and properly impresses the student with the idea that limited evidence requires tentative conclusions. Such debatable ideas as peneplanation and stream-grading are treated circumspectly, and without the aura of *ex cathedra* finality which mars so many introductory textbooks.

According to the foreword by Kirtley Mather, the book is designed for college freshmen. In the reviewer's opinion, it would also be suitable for use in senior high schools where promising students are encouraged to tackle earth science as a new and meaty subject. A textbook of this high quality might help the new earth science curricula avoid the dilettanteism which has plagued so many general science courses in the past.

PEIRCE F. LEWIS
The Pennsylvania State University

Kalahari. JENS BJERRE. Hill and Wang. New York. 1960. 227 pp. illust. $4.50.

This book, an English translation of the original Danish edition of 1958, recounts

the experiences and observations of one of the members of the Danish Kalahari Expedition whose objectives were two-fold: (1) to produce a series of documentary films on the life of the Bushmen and the geographical phenomena of South West Africa, and (2) to collect ethnographical materials for a number of museums. One of the literary products of the expedition, the above book, makes fascinating reading for any American geographer whose interest has at one time or another been piqued by the strange environment and inhabitants of this inhospitable and distant corner of the world.

Obviously, the organization and style are not those that would be followed by a professional geographer; nor do the topics selected for description and analysis always coincide with what are currently considered to be of significance in our field. Nevertheless, for those of us who would seek an intimate glimpse into the daily life of one of the world's most primitive peoples, and who would vicariously view the natural sights of this strange land through the eyes of a skillful observer, there is no better source to which we can turn.

The book makes an excellent addition to the supply of supplementary reading materials that are increasingly available to the geography professor for assignment in his classes. G.F.D.

Geology: Principles and Processes, 5th edition. W.H. EMMONS, I.S. ALLISON, C.R. STAUFFER, AND G.A. THIEL. McGraw-Hill Book Co., Inc. New York. 1960. viii and 491 pp. illust. $7.95.

Slowly but surely, American textbooks on elementary physical geology are converging toward a point of common content and methodology with textbooks on physical geography. This fifth edition of a well known and highly respected college primer in physical geology illustrates the trend.

Included among such standard geologic topics as rocks and minerals, and the various tectonic and gradational processes, are materials dealing with meteorology, climatology, and soils. Any instructor in physical geography, on leafing through the book, would greet as old friends the sections on atmospheric temperature, atmospheric pressure, air movements, atmospheric moisture, pressure belts, prevailing winds, air masses, cyclones and anticyclones, weather forecasting, soil formation, soil classification, and the like.

Moreover, the authors of the book are, for geologists, extraordinarily distribution conscious, for they include not only the typical assemblage of detailed and large-scale topographic maps, cross sections, and sketches that characterize all elementary geology books, but also several dozen world, continent, and regional maps of highly diverse nature. The world maps, for instance, show mean annual precipitation, mean annual atmospheric pressure, volcanic areas, desert areas, and earthquake zones. In other words, it would appear that present day geologists are becoming more area minded than their immediate predecessors.

The increasing similarity of coverage and approach among physical geology and physical geography textbooks, and the presumed concurrently growing correspondence of the college courses based upon such books, pose some interesting problems for the future. As one example, which department in a university, geology or geography, will offer the basic course dealing with all facets of the physical earth? Some bitter intra-departmental battles could precede final decision on this question.

Putting aside such future problems for the nonce, one must commend the authors of the book under review for a splendid job of up-dating, organization, writing, and illustration. In particular, geographer-authors could emulate them in the use of hundreds of two-color maps and diagrams, for color greatly increases the impact of such illustrative materials on the student. The new two-column format of the fifth edition is a pleasing improvement by the publishers. G.F.D.

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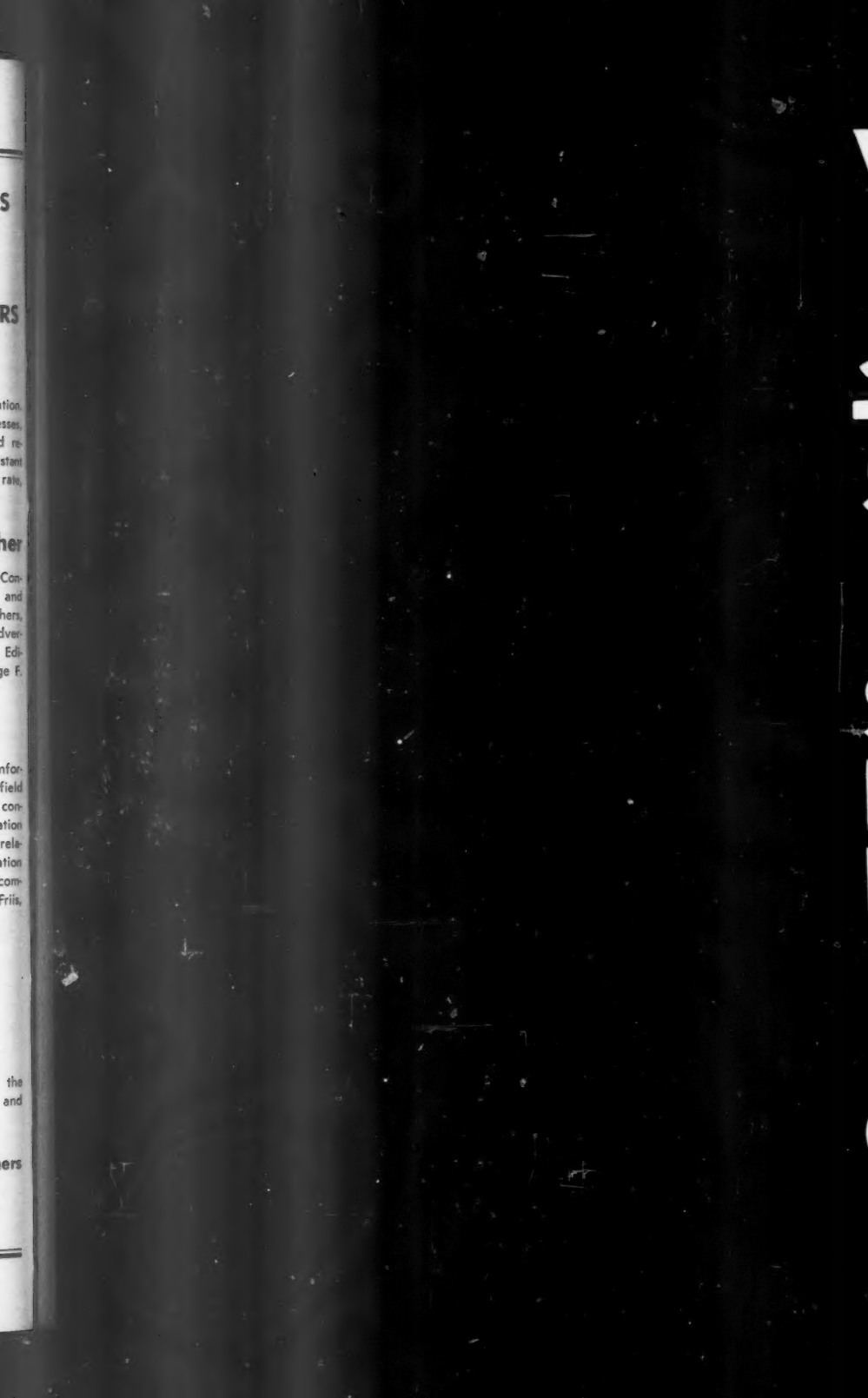
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